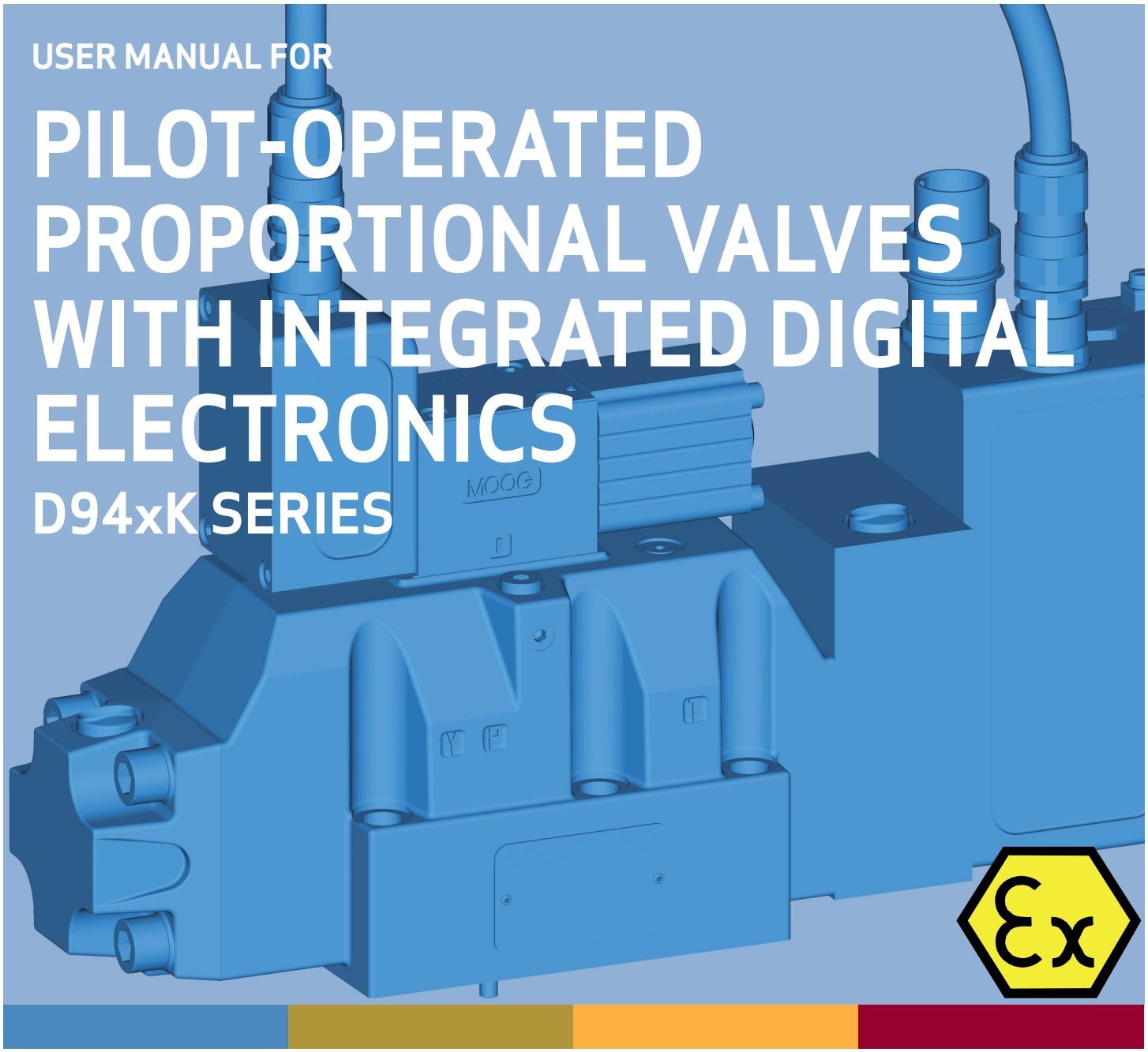
USER MANUAL FOR

PILOT-OPERATED PROPORTIONAL VALVES WITH INTEGRATED DIGITAL ELECTRONICS

D94xK SERIES



Version -, April 2012

PROPORTIONAL VALVES FOR ELECTROHYDRAULIC POSITION, SPEED, PRESSURE AND FORCE CONTROL EVEN FOR HIGH DYNAMIC REQUIREMENTS

WHAT MOVES YOUR WORLD

MOOG

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1 General Information

1.1 Notes on user manual

Notes on user manual

This user manual refers exclusively to the standard models of the valves of the Type series D941K to D945K. It includes the most important notes in order to operate these valves properly and safely.
a Chap. "1.3 Intended operation", page 5
a Chap. "2.1 Handling in accordance with safety requirements", page 14

Special models of the valves custom-made for specific customers, such as for example valves with axis control function (ACV), are not explained in this user manual.
Please contact Moog or one of its authorized service centers for information on these special models.

The contents of this user manual and the product-related hardware and software documentation relevant to the particular application must be read, understood and followed in all points by each person responsible for machine planning, assembly and operation before work with and on the valves is started. This requirement applies in particular to the safety instructions.
a Chap. "1.1.2 Completeness", page 2
a Chap. "1.4 Selection and qualification of personnel", page 7
a Chap. "1.7 Responsibilities", page 10
a Chap. "2.1 Handling in accordance with safety requirements", page 14

This user manual has been prepared with great care in compliance with the relevant regulations, state-of-the-art technology and our many years of knowledge and experience, and the full contents have been generated to the best of the authors' knowledge.
However, the possibility of error remains and improvements are possible.
Please feel free to submit any comments about possible errors and incomplete information to us.

This user manual is also available in German.
On request, translation into other languages is possible.

1.1.1 Subject to change without notice and validity

Subject to change without notice and validity of the user manual

The information contained in this user manual is valid and correct at the moment of release of this version of the user manual. The version number and release date of this user manual are indicated in the footer.
Changes may be made to this user manual at any time and without notice.

1.1.2 Completeness

Completeness of the user manual

This user manual is only complete in conjunction with the product-related hardware and software documentation required for the relevant application.
Available documentation:
a Chap. "1.2 Supplemental documents", page 5

1.1.3 Storage location

Storage location for the user manual

This user manual together with all the product-related hardware and software documentation relevant to the application concerned must at all times be kept close at hand to the valve or the higher-level machine.

1.1.4 Typographical conventions

Warnings

DANGER

warns about an imminent danger to health and life.
Failure to observe this warning can cause severe injuries or even death.
- Make absolutely sure to heed the measures described to prevent this danger

WARNING

warns about a possible situation dangerous to health.
Failure to observe this warning can cause severe injuries or even death.
- Make absolutely sure to heed the measures described to prevent this danger

CAUTION

warns about a possible situation dangerous to health.
Failure to observe this warning can cause slight injuries.
- Make absolutely sure to heed the measures described to prevent this danger

CAUTION

warns about possible property and environmental damage.
Failure to observe this warning can cause damage to the product, a machine or the environment.
- Make absolutely sure to heed the measures described to prevent this danger

Important

Identifies important notes that contain usage tips and special useful information, but no warnings.

• or -	Identifies listings
▸	Indicates an action to be taken
⇨	Identifies references to another chapter, another table or figure
"…"	Denotes headings to the chapters or titles of the documents to which reference is being made
Blue text	Identifies hyperlinks
1., 2., …	Identifies steps in a procedure that must be performed in consecutive order
'...'	Identifies parameters for valve software (e.g.: 'Node ID') or the valve status (e.g.: 'ACTIVE')

1.1.5 Structure of the warning notes

In the present user manual, danger symbols draw attention to remaining dangers in the handling of valves that cannot be constructively avoided. The actions for avoiding danger described must be adhered to.
The warning notes used are structured as follows:

Structure of warning notes

SIGNAL WORD

Type of danger
Consequences
▸ Prevention

Explanation structure of warning notes

- **Warning symbol:** draws attention to the danger
- **Signal word:** indicates the severity of the danger
  - Meaning of the signal words:
    a Chap. "1.1.4 Typographical conventions", page 3
- **Type of danger:** names the type and source of danger
- **Consequences:** describes the consequences in case of non-observance
- **Prevention:** specifies the actions to prevent this danger.

1.2 Supplemental documents

Supplemental documents

The supplementary documents are not included in the valve scope of delivery. They are available as an accessory.
a Chap. "12 Accessories, Spare Parts, and Tools", page 232

The PDF files of the supplemental documents can be downloaded from the following link:
http://www.moog.com/industrial/literature

1.3 Intended operation

Intended operation

The valves may be operated exclusively within the framework of the data and applications specified in the user manual.
Any other or more extensive use is not permitted.

The valves D941K, D942K, D943K, D944K, and D945K are combined in the D94xK type series. The valves are electrical equipment for hazardous areas, protection type "de" (d flameproof enclosure according to IEC 60079-1, e increased safety according to IEC 60079-7).

Identification, D94xK type series:

II 2G Ex d e IIC TX Gb					D94xK
	TX	Temperature environment		Temperature hydraulic fluid	
Sealing material: FKM	T4	-20 °C	60 °C	-20 °C	80 °C
	T5	-20 °C	55 °C	-20 °C	55 °C
	T6	-20 °C	45 °C	-20 °C	45 °C
Sealing material: HNBR	T4	-20 °C	60 °C	-20 °C	75 °C
	T5	-20 °C	55 °C	-20 °C	55 °C
	T6	-20 °C	45 °C	-20 °C	45 °C
Sealing material: T-ECOPUR Temperature range down to -40 °C on request	T6	-40 °C	35 °C	-40 °C	35 °C

Tab. 1: Identification, D94xK type series

The valves may only be operated as a component part of a higher-level overall system, for example in a machine.
They may be used only as control elements to control flow and/or pressure in hydraulic circuits that regulate position, speed, pressure and power.
The valves are intended for use with mineral-oil-based hydraulic oils. Use with other media requires our prior approval.
Correct, reliable and safe operation of the valves requires qualified project planning as well as proper utilization, transportation, storage, mounting, removal, electric and hydraulic connection, start-up, configuration, operation, cleaning and maintenance.

The valves may only be started up when the following is ensured:

- The higher-level machine with all its installed components complies with the latest versions of the relevant national and international regulations, standards, and guidelines (such as, the EU Machinery Directive, ATEX directive, and the regulations of the trade association, TÜV, and VDE).
- The valves and all the other installed components are in a technically fault-free and operationally reliable state.
- No signals that can lead to uncontrolled motions in the machine are transmitted to the valves.

Intended operation also includes the following:

- Observation of this user manual
- Handling of the valves in accordance with safety requirements
  a Chap. "2.1 Handling in accordance with safety requirements", page 14
- Adherence to all the inspection and maintenance instructions of the manufacturer and the operator of the machine
- Observation of all product-related hardware and software documentation relevant to the particular application
- Observation of all safety standards of the manufacturer and the operator of the machine relevant to the application concerned
- Observation of all the latest versions of the national and international regulations, standards, and guidelines relevant to the application concerned (for example, the EU Machinery Directive, the ATEX directive, and the regulations of the trade association, TÜV, and VDE)

1.4 Selection and qualification of personnel

Selection and qualification of personnel

CAUTION

Danger of personal injury and damage to property!
Working with and on the valves without the required basic mechanical, hydraulic, and electrical knowledge may cause injuries or parts may be damaged.

- Only properly qualified and authorized users may work with and on the valves.
- a Chap. "1.4 Selection and qualification of personnel", page 7

Maintenance work by the user on explosion proof valves is not permitted. Intervention by third parties will invalidate the ex certification.

Qualified users

Qualified users are specialized personnel with the required knowledge and experience who have been trained to carry out such work. The specialized personnel must be able to recognize and avert the dangers to which they are exposed when working with and on the valves.
In particular, these specialized personnel must be authorized to operate, earth/ground and mark hydraulic and electrical devices, systems and power circuits in accordance with the standards of safety engineering. Project planners must be fully conversant with automation safety concepts.

Warranty and liability claims in the event of personal injury or damage to property are among others excluded if such injury or damage is caused when the valves are worked on or handled by non-qualified personnel.
a Chap. "1.8 Warranty and liability", page 11

1.5 Structural modifications

DANGER

Danger of explosion!
To guarantee safe operation in hazardous areas:
- Structural modifications of the valves or to accessories may only be made by MOOG GmbH or by an authorized MOOG service center.
- Intervention by third parties will invalidate the Ex certification.

CAUTION

Electrostatic discharge!
To guarantee safe operation in hazardous areas.
The additional painting of our explosion-proof valves by third parties is a structural change. In case of additional painting, due to the possible accumulation of electrostatic charges, the corresponding provisions of the DIN EN 60079-0 standard must be adhered to.

Structural modifications

CAUTION

Risk of damage!
The valves and the accessories can be damaged due to structural changes.
- Due to the complexity of the internal components, structural changes to the valves and to the accessories may only be made by us or our authorized service centers.

Warranty and liability claims for personal injury and damage to property are excluded if they are caused by unauthorized or improperly performed structural modifications or other interventions.
a Chap. "1.8 Warranty and liability", page 11

1.6 Environmental protection

1.6.1 Acoustic Emissions

Environmental protection: Acoustic Emissions

WARNING

Damage to hearing!
Depending on the application, significant levels of noise may be generated when the valves are operated.

- Always protect yourself with hearing protection when working on the valves.

Generally speaking, the valves do not generate harmful acoustic emissions when they are used for their intended purpose.

1.6.2 Disposal

WARNING

Risk of injury!
In order to prevent injuries and other damage to health, please observe the following recommendations.

- Wear appropriate safety clothing.
- Wear protective gloves and safety glasses.
- a Chap. "2.2 Occupational safety and health", page 15

Environmental protection Disposal

It is essential to comply with the relevant national waste disposal regulations and environmental protection provisions when disposing of valves, spare parts or accessories, packaging that is no longer needed, hydraulic fluid or auxiliary materials and substances used for cleaning!
If necessary, the items to be disposed of must be expertly dismantled into individual parts, separated into individual materials and placed in the corresponding waste system or earmarked for recycling.

The valve contains among others the following materials:

- Electronic components
- Adhesives and casting compounds
- Parts with electro-plated surfaces
- Permanent-magnet materials
- Hydraulic fluid
- Assorted metals and plastics

1.7 Responsibilities

Responsibility of the manufacturer and the operator of the machine

The manufacturer and the operator of the machine are responsible for ensuring that work with and on the valves and handling of the valves is planned and performed in accordance with the directions given in this user manual and in the product-related hardware and software documentation relevant to the application concerned.
The manufacturer and the operator of the machine are in particular responsible for ensuring the following:

- Selection and training of personnel
  a Chap. "1.4 Selection and qualification of personnel", page 7
- Intended operation
  a Chap. "1.3 Intended operation", page 5
- Handling in accordance with safety requirements
  a Chap. "2.1 Handling in accordance with safety requirements", page 14
- Taking and monitoring of the occupational safety and health measures required for the particular application
  a Chap. "2.2 Occupational safety and health", page 15
- Observation of all safety standards of the manufacturer and the operator of the machine relevant to the application concerned
- Observation of the latest versions of the national and international regulations, standards, and guidelines relevant to the application concerned (for example, the EU Machinery Directive, the regulations of the trade association and of ATEX guidline, TÜV or VDE) and governing the configuration, construction, and operation of the machine with all its installed components
- Installation of suitable safety devices for limiting the pressure at the hydraulic ports
  a Chap. "2.5 Pressure limitation", page 16
- Compliance with the preconditions for satisfying the EMC protection requirements
  a Chap. "11.2 Electromagnetic compatibility (EMC)", page 173
- Use of the valves in a technically faultless and operationally safe state
- Prevention of unauthorized or improperly performed structural modifications, repairs or maintenance
  a Chap. "1.5 Structural modifications", page 8
  a Chap. "10 Service", page 149
- Definition and observation of the application-specific inspection and maintenance instructions
- Adherence to all the technical data relating to the storage, transportation, installation, removal, connection, start-up, configuration, operation, cleaning, maintenance or elimination of any faults, in particular the ambient conditions and the data pertaining to the hydraulic fluid used
  a Chap. "11 Technical Data", page 162
- Proper storage, transportation, installation, removal, connection, start-up, configuration, operation, cleaning, maintenance, elimination of any faults or disposal
- Use of suitable and faultless accessories and of suitable and faultless spare parts
  a Chap. "12 Accessories, Spare Parts, and Tools", page 232
- Handy and accessible storage of this user manual and of the product-related hardware and software documentation relevant to the particular application
  a Chap. "1.1.3 Storage location", page 2

1.8 Warranty and liability

Our General Terms and Conditions of Sale and Payment always apply. These are made available to the buyer at the latest on conclusion of the contract.

Exclusion of warranty and liability

Among other things, warranty and liability claims for personal injury and damage to property are excluded if they are caused by one or more of the following:

- Work with and on the valves carried out by or the valves handled by non-qualified personnel
  a Chap. "1.4 Selection and qualification of personnel", page 7
- Non-intended operation
  a Chap. "1.3 Intended operation", page 5
- Handling not in accordance with safety requirements
  a Chap. "2.1 Handling in accordance with safety requirements", page 14
- Omission of the occupational safety and health measures required for the particular application
  a Chap. "2.2 Occupational safety and health", page 15
- Failure to observe this user manual or the product-related hardware and software documentation relevant to the particular application
- Failure to observe the safety standards of the manufacturer and the operator of the machine relevant to the application concerned
- Failure to observe the latest versions of the national and international regulations, standards, and guidelines relevant to the application concerned (for example, the EU Machinery Directive, the regulations of the trade association and of TÜV or VDE) and governing the configuration, construction, and operation of the machine with all its installed components
- Omission of suitable safety devices for limiting the pressure at the hydraulic ports
  a Chap. "2.5 Pressure limitation", page 16
- Failure to comply with the preconditions for satisfying the EMC protection requirements
  a Chap. "11.2 Electromagnetic compatibility (EMC)", page 173
- Use of the valves in a state that is not technically faultless or not operationally safe
- Unauthorized or improperly performed structural modifications, repairs or maintenance
  a Chap. "1.5 Structural modifications", page 8
  a Chap. "10 Service", page 149
- Failure to adhere to the inspection and maintenance instructions of the manufacturer and the operator of machine
- Failure to adhere to all the technical data relating to the storage, transportation, installation, removal, connection, start-up, configuration, operation, cleaning, maintenance or elimination of any faults, in particular the ambient conditions and the data pertaining to the hydraulic fluid used
  a Chap. "11 Technical Data", page 162
- Improper storage, transportation, installation, removal, connection, start-up, configuration, operation, cleaning, maintenance, elimination of any faults or disposal
- Use of unsuitable or defective accessories or of unsuitable or defective spare parts
  a Chap. "12 Accessories, Spare Parts, and Tools", page 232
- Catastrophes caused by foreign objects or force majeure

1.9 Declaration of conformity

Declaration of conformity

An ATEX directive-compliant declaration of conformity for the control valves of the D94xK type series has been created and is depicted in this user manual.

MOOG

MOOG GmbH
Hanns-Klemm-Str. 28
71034 Böblingen

Division Industry

Declaration of conformity

as defined by directive 94/9/EC (ATEX), Annex X

Herewith we declare that the

Series of Servovalves
D67xKxxxx, D94xKxxxx

(detailed model & serial number is referenced on the delivery note)

are in conformance with the provisions of the directive 94/9/EC (ATEX).

The admission of the series is registered under **BVS 11 ATEX E 122 X**
by DEKRA EXAM GmbH, Dinnendahlstrasse 9, 44809 Bochum, Germany
The monitoring body of the QM system is **TÜV Süd (0123)**

Applied harmonized standards in particular:

EN 60079-0:2009	Electrical apparatus for potentially explosive atmospheres - General requirements.
EN 60079-1:2007	Electrical apparatus for potentially explosive atmospheres - Flameproof enclosures "d".
EN 60079-7:2007	Electrical apparatus for potentially explosive atmospheres - Increased safety "e".

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Böblingen, 29.08.2011

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1.10 Registered marks and trademarks

Registered marks and trademarks

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All the product and company names mentioned in this user manual are possibly proprietary names or trademarks of the respective manufacturers. The use of these names by third parties for their own purposes may infringe the rights of the manufacturers.
The absence of the symbols ® or ™ does not indicate that the name is free from trademark protection.

2 Safety

2.1 Handling in accordance with safety requirements

Handling in accordance with safety requirements

It is the responsibility of the manufacturer and the operator of the machine to ensure that the valves are handled in accordance with safety requirements.

CAUTION

Danger of personal injury and damage to property due to unexpected operation!
As in any electronic control system, the failure of certain components in valves as well might lead to an uncontrolled and/or unpredictable operational sequence.

- If automatic control technology is to be used, the user should, in addition to all the potentially available standards or guidelines on safety-engineering installations, consult the manufacturers of the components used in great depth.

In order to ensure that the valves are handled in accordance with safety requirements and operated without faults, it is essential to observe the following:

- All the safety instructions in the user manual
- All the safety instructions in the product-related hardware and software documentation relevant to the particular application
- All the safety instructions in the safety standards of the manufacturer and the operator of the machine that are relevant to the application concerned
- All the relevant national and international safety and accident prevention regulations, standards, and guidelines, such as the safety regulations of the trade association, TÜV or VDE, the ATEX product directive 94/9/EC, and the ATEX operating directive 1999/92/EC; in particular, the following standards pertaining to the safety of machinery:
  - EN ISO 12100
  - EN 982
  - EN 563
  - EN 60204
  - EN 60079-0
  - EN 60079-1
  - EN 60079-7

Observing the safety instructions and the safety and accident prevention regulations, standards and guidelines will help to prevent accidents, malfunctions and damage to property!

2.2 Occupational safety and health

Occupational safety and health measures and equipment

DANGER

Risk of poisoning and injury!
Contact with hydraulic fluids can damage your health (e.g. eye injuries, skin and tissue damage, poisoning in case of inhaling).

- Wear protective gloves and safety glasses.
- If nevertheless hydraulic fluid gets into your eyes or on your skin, consult a doctor immediately.
- When handling hydraulic fluids, observe the safety provisions applicable to the hydraulic fluid used.

WARNING

Danger of injury due to falling objects!
Falling objects, such as valves, tools, or accessories, can cause injury.

- Wear appropriate safety clothing, e.g. safety shoes.

WARNING

Danger of burning!
Valves and hydraulic port lines can become very hot during operation. Fingers and hands can suffer severe burn injuries when touching the valve or the connector cable.

- Allow the valve and the connector cable to cool off before contact.
- Wear appropriate safety clothing, e.g. safety gloves.

WARNING

Damage to hearing!
Depending on the application, significant levels of noise may be generated when the valves are operated.

- Always protect yourself with hearing protection when working on the valves.

2.3 General safety instructions

General safety instructions

CAUTION

Risk of damage!
In order to prevent damage to the valves or to the machine, the following must be observed:
- Values specified in the technical data must be adhered to.
- Values specified on the nameplate must be adhered to.
- a Chap. "11 Technical Data", page 162

This user manual and the product-related hardware and software documentation relevant to the application concerned must be inserted in the machine's operating instructions.

2.4 ESD

ESD

CAUTION

Risk of damage!
Electrical discharges can damage internal device components.
- Protect the valve, accessories and spare parts against static charging. In particular, avoid touching the connector contacts.

2.5 Pressure limitation

Safety devices for pressure limitation

WARNING

Danger of personal injury and damage to property!
The operation of the valves at pressure that is too high on the hydraulic connections can cause injuries and damage to the machine.
- Pressure-limiting valves or other comparable safety devices, for example, must be installed to limit the pressure at all the hydraulic ports to the specified maximum operating pressure. Maximum operating pressure:
  ⇨ Chap. "11 Technical Data", page 162

3 Product Description

3.1 Function and mode of operation

Function and mode of operation of the valves

The valves in the D941K to D945K type series are two-stage proportional valves with a direct-operated pilot valve (Fig. 1, D633K with permanent magnet linear force motor). The valves are throttle valves for 2-, 3-, 4-, 5- or even 2/2x2-way applications.

They are suitable for electrohydraulic position, speed, pressure, and force control even with high dynamic requirements. They control flow and/or control pressure.

The valve electronics with a PWM driver end stage and a 24 V direct current supply are integrated into the valve.
The digital valve electronics are installed in the electronic housing in vibration-decoupled design so that they are not sensitive to shock and vibration.

For a detailed description of how these work, see
a Chap. "3.1.3 Representative depiction of the valve", page 19
a Chap. "3.3.1.1 Flow control (Q-control)", page 35

3.1.1 Operational modes

Depending on the model, one of the operational modes below is preset in the valve.
It is possible to switch between the operational modes via the integrated service or fieldbus interface.

Operational modes: Q, p, pQ control

Operational mode	D94xK		
	Q	p	pQ
Flow control (Q-control) a Chap. "3.3.1.1 Flow control (Q-control)", page 35	• [1)]		•
Pressure control (p-control) a Chap. "3.3.1.2 Pressure control (p-control)", page 36		• [1]	•
Flow and pressure control (pQ-control) a Chap. "3.3.1.3 Flow and pressure control (pQ-control)", page 37			• [1]

Tab. 2: Operational modes of the valves

[1)] Operational mode preset on delivery

3.1.2 Pilot pressure

Pilot pressure

If large flows are required with a high valve pressure difference, a correspondingly high pilot pressure must be selected to overcome the flow forces.

For reliable function of the valves, we recommend the following pilot pressure p_x :

For valves with stub shaft spool $p_x \geq p_P$
For valves with standard spool $p_x \geq 0.3 \times p_P$

whereby
p_P = pressure on the P port of the valve (pressure supply)

The control pressure specified in the technical data must be adhered to.
a Chap. "11.1 Nameplates", Digit 3, pressure range identification, page 167

Hydraulic safety devices for pressure limitation

Safety devices for pressure limitation

Excessive pressure at the hydraulic ports damages the valve and can cause unsafe states in the machine as well as personal injury.
Pressure-limiting valves or other comparable safety devices, for example, must be installed to limit the pressure at all the hydraulic ports to the specified maximum operating pressure.
a Chap. "2.5 Pressure limitation"

3.1.3 Representative depiction of the valve

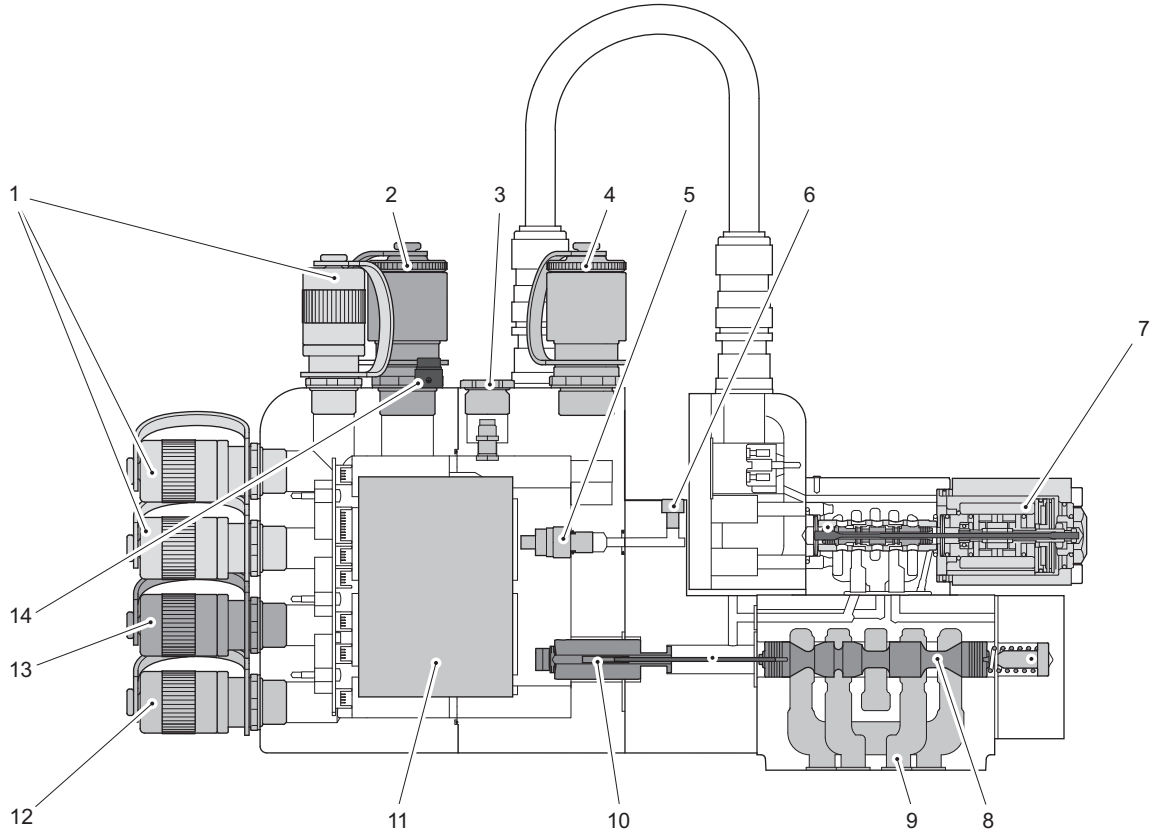


Fig. 1: Representative depiction of a two-stage proportional valve with directly-operated pilot valve D633K

Item	Designation	Additional information
1	Analog input connector X5...X7	The analog input connectors X5…X7 are optionally available.
2	Connector X2 for digital signal interface	The X2 connector is optionally available.
3	Service connector X10	The X10 service connector is only present for valves without CAN bus interface. As standard, the X10 service connector is not approved for use in hazardous areas; however, on request it can be obtained as a version that is suitable for use in hazardous areas. Tightening torque: tighten the screw plug of the service connector with tightening torque 9.5 Nm / 7 lbf ft! a Chap. "7.10 Service connector X10", page 92
4	Connector X1	a Chap. "7.4 Connector X1"
5	Pressure transducer	
6	Venting screw	a Chap. "8.5.1 Venting", page 140
7	Pilot valve D633K	a Chap. "3.1.4 Permanent magnet linear force motor", page 21
8	Main stage spool	
9	Ports	Mounting surface: Hole pattern, D941K (NG10) type series a Fig. 56, page 175 Hole pattern, D942K (NG16) type series a Fig. 64, page 186 Hole pattern, D943K (NG25) type series a Fig. 72, page 197 Hole pattern, D944K (NG25) type series a Fig. 80, page 208 Hole pattern, D945K (NG32) type series a Fig. 88, page 219
10	LVDT	a Chap. "3.3.1.1 Flow control (Q-control)", page 35

Item	Designation	Additional information
11	Digital valve electronics	a Chap. "3.1.5 Valve electronics and valve software", page 22
12	Fieldbus-X3 connector	The fieldbus connectors X3 and X4 are only provided on valves with fieldbus interfaces. a Chap. "7.8 Field bus connectors X3 and X4", page 84 a Chap. "8.3.1 Configuration via the fieldbus interface", page 135
13	Fieldbus-X4 connector	
14	Ground terminal	a Chap. "7.12 Protective grounding, equipotential bonding, and shielding"

3.1.4 Permanent magnet linear force motor

Representative depiction of the pilot valve with permanent magnet linear force motor

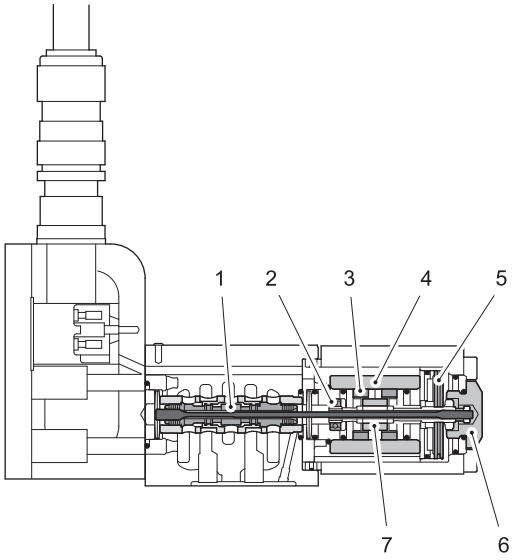


Fig. 2: Representative depiction of the permanent magnet linear motor (D633K)

Item	Designation
1	Spool
2	Bearing
3	Permanent magnet
4	Coil
5	Centering springs
6	screw plug
7	Armature

Permanent magnet linear force motor

A permanent magnet linear force motor is used to drive the valve spool (item 1 in Fig. 2) of the pilot valve.
In contrast to proportional-solenoid drives, the permanent magnet linear force motor can move the spool from the spring-set position in both working directions. This results in high actuating power for the spool while simultaneously providing very good static and dynamic properties.
The permanent magnet linear force motor is a differential motor excited by permanent magnets. Some of the magnetic force is already provided by the permanent magnets. The linear force motor's power demand is thus significantly lower than is the case with comparable proportional-magnet drives.
The linear force motor drives the valve's spool (item 1, Fig. 2). The spool starting position is determined in the de-energized state by the centering springs (item 5 in Fig. 2). The linear force motor enables the spool to be deflected from the starting position in both directions. Here, the actuating power of the linear force motor is proportional to the coil current.
The high forces of the linear force motor and centering springs effect precise spool movement even against flow and frictional forces.

3.1.5 Valve electronics and valve software

Integrated digital valve electronics and valve software

The digital drive and control electronics are integrated in the valve.
These valve electronics contain a microprocessor system that executes all the important functions via the valve software it contains. The digital electronics enable valve control that is both precise and repeatable across the full working range regardless of temperature.

The valve electronics can assume device- and drive-specific functions, such as command signal ramps or dead band compensation.
This can relieve the strain on external machine control and if necessary field-bus communication.

a Chap. "3.5 Configuration software", page 53

a Chap. "8.3 Configuration of the valves", page 135

3.1.5.1 Valve status

CAUTION

Danger of personal injury and damage to property!
The 'NOT READY' valve status is caused only by a serious, non-rectifiable fault.

- If the 'NOT READY' valve status occurs, the valve must be sent to MOOG GmbH or an authorized MOOG service center for inspection.

Valve status

The valve's device status is referred to as the valve status.
The valve status can be set or interrogated via the service or fieldbus interface in the valve software. Setting and interrogation can be performed for example with the Moog Valve and Pump Configuration Software.

Valve status	Explanation
'ACTIVE'	The valve is ready for operation and is in closed-loop control operation.
'HOLD'	The valve is ready for operation and is in the electrical fail-safe state on account of a control command. The electrical fail-safe spool position is a closed loop parameterized setting. a Chap. "3.2.2 Electrical fail-safe function", page 30
'FAULT HOLD'	The valve is ready for operation and is in the electrical fail-safe state on account of a fault reaction. The electrical fail-safe spool position is a closed loop parameterized setting. a Chap. "3.2.2 Electrical fail-safe function", page 30
'DISABLED'	The valve electronics are ready for operation and the valve is in the mechanical fail-safe state on account of a control command. a Chap. "3.2.1.3 Mechanical fail-safe state", page 29 Internal parameters can be set and interrogated. The current to the permanent magnet linear force motor is switched off.
'FAULT DISABLED'	The valve electronics are ready for operation and the valve is in the mechanical fail-safe state on account of a fault reaction. Internal parameters can be set and interrogated. a Chap. "3.2.1.3 Mechanical fail-safe state", page 29 The current to the permanent magnet linear force motor is switched off.
'INIT'	The valve is switched off, is in the mechanical fail-safe state and can be configured via the service or field bus interface. a Chap. "3.2.1.3 Mechanical fail-safe state", page 29
'NOT READY'	The valve is not ready for operation and is in the mechanical fail-safe state on account of a serious non-rectifiable fault. a Chap. "3.2.1.3 Mechanical fail-safe state", page 29

Tab. 3: Valve status

Fail-safe states and fail-safe events:
a Chap. "3.2.1.3 Mechanical fail-safe state", page 29
a Chap. "3.2.3 Fail-safe events", page 30
a Chap. "11.1 Nameplates", Digit 6, Fail-safe variant, page 169

3.1.6 Signal interfaces

The valves have a connector, X1, with model-dependent analog and digital inputs/outputs. The connectors are an explosion-proof model.
a Chap. "3.1.6.1 Connector X1", page 25
Pin assignment of the connector X1:
a Chap. "7.4.1 Pin assignment of connector X1", page 76

WARNING

Danger of explosion!
To guarantee safe operation in a hazardous area:
- For mounting and removal of the explosion-proof connectors as well as operation of the valve, the notes and instructions in the "Explosion-proof connectors eXLink, CEAG" operating instructions must absolutely be adhered to.

Depending on the model, the valves can also have an isolated field bus interface (connectors X3 and X4) and/or a service interface (service connector X10).
a Chap. "3.1.6.2 Fieldbus connectors X3 and X4", page 25
a Chap. "3.1.6.3 Service connector X10", page 26

For the standard model of the valve, the service interface is not suitable for use in hazardous areas. On request, the service interface is available in an explosion-proof model.

Interfaces for activation signals

	Interfaces		
	Connector X1	Field bus connectors X3 and X4	Service connector X10
Valves without field bus interface	•	-	• [1)]
Valves with CAN bus interface	•	• [1]	-
Valves with Profibus interface	•	•	• [1]
Valves with EtherCAT interface	•	•	• [1]

Tab. 4: Existing signal interfaces

[1)] The valves can be started up and configured via the CAN bus or service interface with the Moog Valve and Pump Configuration Software.
a Chap. "8.3.1.2 Configuration with the Moog Valve and Pump Configuration Software", page 136

It is necessary when ordering the valve to establish whether a field bus interface is to be integrated and if necessary one of the above-mentioned field bus interfaces is to be selected.

3.1.6.1 Connector X1

Activation of the Valve Command

Valves without field bus interfaces must be commanded with an analog signal(s) via connector X1.
Valves with field bus interfaces can be controlled either with analog command signals via connector X1 or with digital signals via the field bus interface (connectors X3 and X4).
⇨ Chap. "3.4 Control", page 43

Analog command inputs

Different signal types for analog command inputs for flow control can, depending on the model, be selected in the valve.
a Chap. "3.4.1 Signal types for set-point and actual value", page 44

Analog actual value output

The valves have an analog actual value output:
a Chap. "3.4.2 Analog actual value output", page 52

Enable input

The valves have a digital enable input.
a Chap. "3.4.3 Digital enable input", page 52

Pin assignment of connector X1:
a Chap. "7.4.1 Pin assignment of connector X1", page 76

3.1.6.2 Fieldbus connectors X3 and X4

Fieldbus connectors X3 and X4

Valves with field bus interfaces are started up, activated, monitored and configured via the field bus interface (connectors X3 and X4).
a Chap. "8.3.1 Configuration via the fieldbus interface", page 135
To reduce the amount of wiring, the field bus interface is provided with two connectors on the valve. The valves can thus be directly looped into the field bus, i.e. without the use of external T-pieces.

Valves with CAN bus interfaces can be started up and configured via the CAN bus interface (field bus connector X3) with the Moog Valve and Pump Configuration Software.
a Chap. "8.3.1.2 Configuration with the Moog Valve and Pump Configuration Software", page 136
Plug assignment of the field bus connectors X3 and X4:
a Chap. "7.8 Field bus connectors X3 and X4", page 84

3.1.6.3 Service connector X10

Service connector X10

Valves without CAN bus interfaces can be started up and configured via the service interface (service connector-X10) with the Moog Valve and Pump Configuration Software.
a Chap. "8.3.2 Configuration via the service interface", page 136

WARNING

Danger of explosion!
To guarantee safe operation in hazardous areas, the following points must be heeded:

- In its standard model with screw plug, the service connector X10 is not approved for use in hazardous areas.
- For mounting of the screw plug of the service connector X10, it must be observed that the gasket and the threads of the screw plug as well as the threads in the electronic housing of the valve are not damaged.
- In case of damage to the screw plug for the service connector X10 or the threads in the electronic housing, the valve must not be operated.
- Tightening torque screw plug:
  a Chap. "3.1.3 Representative depiction of the valve", page 19

For the standard model of the valve, the service interface is not suitable for use in hazardous areas. On request, the service interface is available in an explosion-proof model.

3.2 Safety function/fail-safe

CAUTION

Risk of injury!
In order to prevent injuries and other damage to health during safety-critical operation, please observe the following recommendations.
a Chap. "2.1 Handling in accordance with safety requirements", page 14

CAUTION

Fail-safe functions

Risk of injury!
In order to prevent injuries and other damage to health during the design, building, and operation of the machine with all installed components, please heed the following instructions.

- The manufacturer and operator of the machine are responsible for making sure that for safety-critical use, relevant safety standards in the latest version, which serve to avoid damage, are heeded.
- It is vital among other things to ensure that both the individual components and the complete machine can be rendered in a safe state.

The valve fail-safe functions increase the safety for the user if, for example the valve supply voltage fails or the pilot pressure p_X drops.
There are two different fail-safe functions: mechanical/hydraulic and electrical.
a Chap. "3.2.1 Mechanical fail-safe function", page 28

The valve can be rendered in the fail-safe state by different events.
a Chap. "3.2.3 Fail-safe events", page 30

Mechanical/ hydraulic fail-safe state

The mechanical/hydraulic valve fail-safe state is denoted by the fact that the spool of the main stage is in a defined spring-determined position.
a Chap. "3.2.1.3 Mechanical fail-safe state", page 29

Electrical fail-safe state

The electrical valve fail-safe state is denoted by the fact that the valve is in the 'HOLD' or 'FAULT HOLD' valve status and a preset command signal is corrected by suitable positioning of the main stage spool.

It is essential to ensure at the machine end that these fail-safe states result in a safe state in the machine.

The valve must be restarted after it has adopted the fail-safe state.
a Chap. "3.2.4 Restarting the valve", page 33

3.2.1 Mechanical fail-safe function

Mechanical fail-safe functions

The vavles in the D67XK series are offered with various fail-safe functions. The behavior of the valve in the fail-safe function depends on the fail-safe function selected, the pilot valve, as well as the respective status of pilot pressure and control pressure of the 4/2-way valve.

The fail-safe function must be specified when the valve is ordered. To see which fail-safe function is integrated into the valve, see the 6th place in the type designation.
a Chap. "3.2.1.4 Fail-safe identification", page 29

The following fail-safe functions are available:

- Fail-safe function F
- Fail-safe function D
- Fail-safe function H
- Fail-safe function K

3.2.1.1 Valves with fail-safe functions F, D and M

Fail-safe functions F, D and M

In the case of the fail-safe functions F, D and M, the mechanical setting of the linear force motor or corresponding centering springs at the factory establishes which position the spool assumes in the mechanical fail-safe state.
Position of main stage spool: a Tab. 3, page 23

The installation drawing/dimensions of the valves are type-dependent
a Chap. "11 Technical Data", page 162

Hydraulic symbols:
a Chap. "3.3.2 Valve configurations and hydraulic symbols", page 38

3.2.1.2 Valves with fail-safe functions H and K

Valves with fail-safe functions H and K (fail-safe valves)

The valves with fail-safe function H and K with 4/2-way seat valves are called fail-safe valves.

For applications with proportional valves, for which certain safety specifications apply to prevent danger to man and machine, it must be possible to assume a corresponding spool setting for a safe state.. Therefore, a fail-safe model is available for the multi-stage proportional valves.

After external triggering, this fail-safe function applies a defined spool setting: safe middle position or open position A→T or B→T.
For fail-safe valves in the D94xK series, both control spaces of the main stage are short-circuited hydraulically via a 4/2-way valve to move the spool of the main stage to the safe middle position. The spring-set force moves the spool into the safe fail-safe position.

For fail-safe valves it is possible to monitor whether the main spool is in the safe position:

Installation drawing/dimensions:
a Chap. "11 Technical Data", page 162

Hydraulic symbols:
a Chap. "3.3.2 Valve configurations and hydraulic symbols", page 38

3.2.1.3 Mechanical fail-safe state

The valve is in the mechanical fail-safe state when the main stage spool is in a defined spring-determined position.

The spool positions of the main stage in case of failure of the valve electronics or of the control pressure of the 4/2-way valve are described in the tables about the fail-safe function in the technical data.
a Tab. 31, page 169

Type designation:
a Chap. "11.1 Nameplates", Digit 6, Fail-safe variant, page 169

All other combinations of pressure and supply voltage give rise to an undefined main stage spool position.

3.2.1.4 Fail-safe identification

Fail-safe identification

The fail-safe identification, i.e. the 6th position in the valve type designation of the proportional or servo valve, indicates which mechanical fail-safe function is integrated in the valve.

Type designation:
a Chap. "11.1 Nameplates", Digit 6, Fail-safe variant, page 169

3.2.1.5 spool identification

spool identification

The spool identification, i.e. the 4th position in the valve type designation, indicates which spool version is integrated in the valve.

Type designation:
a Chap. "11.1 Nameplates", Digit 4, Spool, page 168

3.2.2 Electrical fail-safe function

Electrical fail-safe function

After adopting the 'HOLD' or 'FAULT HOLD' valve status, the valve is in the electrical fail-safe state and a preset command signal is corrected by suitable positioning of the main stage spool.
The command signal can be set or interrogated via the service or field bus interface in the valve software. Setting and interrogation can be performed for example with the Moog Valve and Pump Configuration Software.
Command signals that may be applied from an external source via the field bus interface or the analog inputs are ignored in the 'HOLD' and 'FAULT HOLD' valve states.

3.2.3 Fail-safe events

CAUTION

Danger of personal injury and damage to property!
The 'NOT READY' valve status is caused only by a serious, non-rectifiable fault.

- If the 'NOT READY' valve status occurs, the valve must be sent to MOOG GmbH or an authorized MOOG service center for inspection.

Fail-safe events

The valve is rendered in the fail-safe state in response to the fail-safe events set out below.
The valve must be restarted after it has adopted the fail-safe state.
a Chap. "3.2.4 Restarting the valve", page 33

Fail-safe event		Fail-safe state		Cause of adoption of fail-safe state		
		Mechan.	Electr.	External event	Settable fault reaction	Control command
Shutdown/failure of the supply voltage		•		•		
Signals on the enable input of the X1 connector (not possible for p/Q function)		•		•		
Drop in the pilot pressure p_X		•		•		
Adoption by valve of valve status	'HOLD'		•			•
	'FAULT HOLD'		•		•	
	'DISABLED'	•				•
	'FAULT DISABLED'	•			•	
	'INIT'	•				•
	'NOT READY'	•		• Serious, non-rectifiable fault		

Tab. 5: Fail-safe events

3.2.3.1 Shutdown/failure of the supply voltage

Fail-safe due to shutdown/failure of the supply voltage

CAUTION

Risk of damage!
After the supply voltage to the valve is shut down, fails or drops below 18 V, the linear force motor is no longer activated by the valve electronics.

- The cause of the fault must be determined on the machine side and if necessary, eliminated.

The valves with fail-safe functions F and D are rendered in the mechanical fail-safe state when the supply voltage is shut down or fails.

With the pilot pressure applied, the mechanical setting of the pilot valve defines which end face of the main stage spool is pressurized with pilot pressure and thus which position the spool assumes in the hydraulic fail-safe state.
Position of main stage spool:
a Tab. 31, page 169

3.2.3.2 Signals at the enable input

Fail-safe due to signals at the enable input

Switching of the valve to fail-safe state can also be triggered by a corresponding signal at the enable input of connector X1. Signals lower than 6.5 V at the enable input switch the valve to fail-safe state.
a Chap. "3.4.3 Digital enable input", page 52
(Not for valves with pQ control.)

Pin assignment of connector X1:
a Chap. "7.4.1 Pin assignment of connector X1", page 76

3.2.3.3 Drop in the pilot pressure p_X

Fail-safe due to drop in the pilot pressure p_X

After the pilot pressure p_X has dropped below[1)] (depressurized), the main stage spool is pushed by the spring restoring force into the defined spring-determined center position denoting the mechanical fail-safe state of the valves.
Position of main stage spool:
a Tab. 31, page 169

[1)] Pilot pressure values:
a Chap. "11.1 Nameplates", Digit 3, pressure range identification, page 167
a Chap. "11.1 Nameplates", Digit 6, Fail-safe variant, page 169

3.2.3.4 Settable fault reaction

CAUTION

Danger of personal injury and damage to property!
The 'NOT READY' valve status is caused only by a serious, non-rectifiable fault.

- If the 'NOT READY' valve status occurs, the valve must be sent to MOOG GmbH or an authorized MOOG service center for inspection.

Mechanical fail-safe state due to fault reaction

Mechanical fail-safe state due to fault reaction

Adoption by the valve of the 'FAULT DISABLED' valve status and thus of the mechanical fail-safe state can be triggered by different events, such as e.g. the supply voltage dropping below 18 V.
It is possible to set in the valve software the event(s) for which the valve is rendered in the 'FAULT DISABLED' valve status.
The setting can be made or interrogated via the service or fieldbus interface in the valve software. Setting and interrogation can be performed for example with the Moog Valve and Pump Configuration Software.
a Chap. "3.6 Moog Valve and Pump Configuration Software", page 54

The transition of the valve into the 'NOT READY' valve status and therefore into the mechanical fail-safe state is caused by a serious, non-rectifiable fault.

Electrical fail-safe state due to fault reaction

Electrical fail-safe state due to fault reaction

The transition of the valve into the 'FAULT HOLD' valve status and therefore into the electrical fail-safe state can be initiated by different events, such as e.g. a fault in the electric cable
It is possible to set in the valve software the event(s) for which the valve is rendered in the 'FAULT HOLD' valve status.
The valve state can be set or interrogated via the service or field bus interface in the valve software. Setting and interrogation can be performed for example with the Moog Valve and Pump Configuration Software.
a Chap. "3.6 Moog Valve and Pump Configuration Software", page 54

3.2.3.5 Control commands

Control commands

The transition of the valve into the 'HOLD', 'DISABLED' and 'INIT' valve states can be initiated by a control command.

3.2.4 Restarting the valve

Restarting the valve

WARNING

Danger of injury due to unexpected machine movements!
In order to avoid injuries and other risks to health on start-up of the valve after a transition into the fail-safe state, please follow the following instructions.

- The cause of the fault must be determined on the machine side and if necessary, eliminated.
- It is necessary to ensure that restarting the valve does not give rise to unintentional or dangerous states in the machine.

After shutdown/failure of the supply voltage:
After the transition of the valve into a fail-safe state on account of a shut-down/failure of the supply voltage to the valve, it will be necessary to restart the valve by applying the supply voltage in accordance with the technical data. If necessary, the valve must be returned to the 'ACTIVE' valve status.

After application of an enable signal lower than 6.5 V:
After the transition of the valve into a fail-safe state on account of the application of an enable signal lower than 6.5 V, it will be necessary to restart the valve by applying an enable signal between 8.5 V and 32 V.

After a drop in the pilot pressure p_X:
After the valve has adopted the fail-safe state on account of a drop in the pilot pressure p_X, it will be necessary to restart the valve by applying a higher pilot pressure.

Pilot pressure values:
a Chap. "11.1 Nameplates", Digit 3, pressure range identification, page 167
a Chap. "11.1 Nameplates", Digit 6, Fail-safe variant, page 169

After transition of the valve into of the 'FAULT DISABLED' or 'FAULT HOLD' valve status:
After transition of the valve into the fail-safe state on account of a transition into the 'FAULT DISABLED' or 'FAULT HOLD' valve status, it can be restarted as follows:

- Acknowledge the fault via the service or field bus interface and return the valve to the 'ACTIVE' valve status.
- Set the supply voltage for at least 1 second under defined conditions to zero and then restore the supply voltage in accordance with the technical data. If necessary, the valve must be returned to the 'ACTIVE' valve status.

After transition of the valve into the 'HOLD', 'DISABLED' or 'INIT' valve status:
After the transition of the valve into the fail-safe state on account of adoption of the 'DISABLED' or 'INIT' valve status, it can be restarted as follows:

- Return the valve to the 'ACTIVE' valve status.
- Apply an enable signal less than 6.5 V, then apply an enable signal between 8.5 V and 32 V and return the valve to the 'ACTIVE' valve status.
- For valves without fieldbus interface: set the supply voltage for at least 1 second under defined conditions to zero and then restore the supply voltage in accordance with the technical data.

3.3 Hydraulics

CAUTION

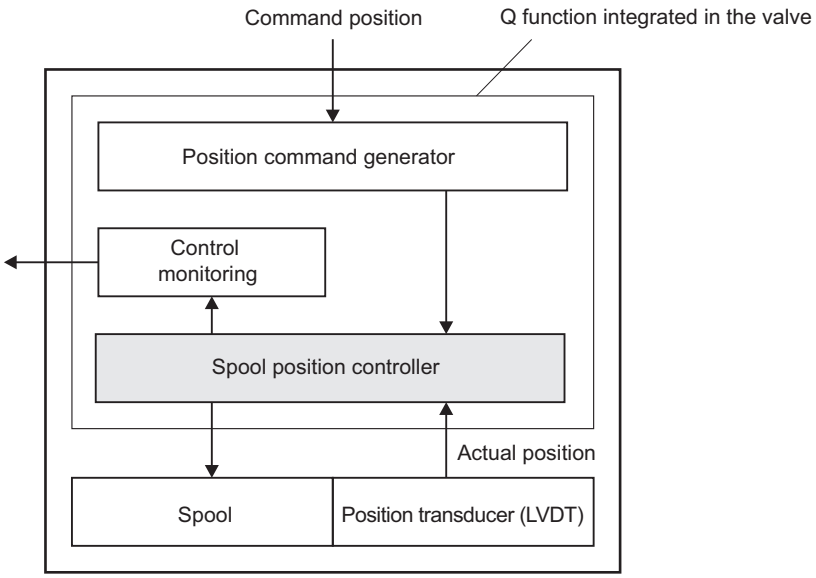
Danger of personal injury and damage to property due to spraying fluids!
In order to ensure proper operation of the valves and of the machine, the following must be observed:

- The correct configuration of the valve with regard to flow and pressure is required.

3.3.1 Operational modes

Possible operational modes of the different Series: a Tab. 2, page 17

3.3.1.1 Flow control (Q-control)



Flow control (Q-control): Controlling the position of the main stage spool

Fig. 3: Flow control (Q-control) block diagram

In this operational mode the position of the main stage spool is controlled. The predefined command signal corresponds to a particular spool position. The position of the spool is proportional to the control signal.

The command signal (command position for the main stage spool) is transmitted to the valve electronics. The actual spool position is measured with a position transducer (LVDT) and transmitted to the valve electronics.
Deviations between the predefined command position and the measured actual position of the spool are corrected. The valve electronics activate the pilot valve, which positions the spool accordingly.This process sets a specific flow.

The position command can be influenced by means of parameters in the valve software (e.g., linearization, ramping, dead band, sectionally defined amplification, correction of the zero position).

The parameters can be set or interrogated via the service or field bus interface in the valve software. Setting and interrogation can be performed for example with the Moog Valve and Pump Configuration Software.

The flow rate to be set depends not only on the position of the spool, but also on the pressure difference Δ p at the individual control lands.

a Chap. "3.5 Configuration software", page 53
a Chap. "4.1 Flow diagram (4-way operation)", page 55

Characteristic curves
a Chap. "11 Technical Data", page 162

3.3.1.2 Pressure control (p-control)

Faultless valve functioning for pressure control is only guaranteed if the control loop is stable and the pressure in port T is lower than the pressure to be controlled.

Pressure control (p control): Controlling the pressure in port A

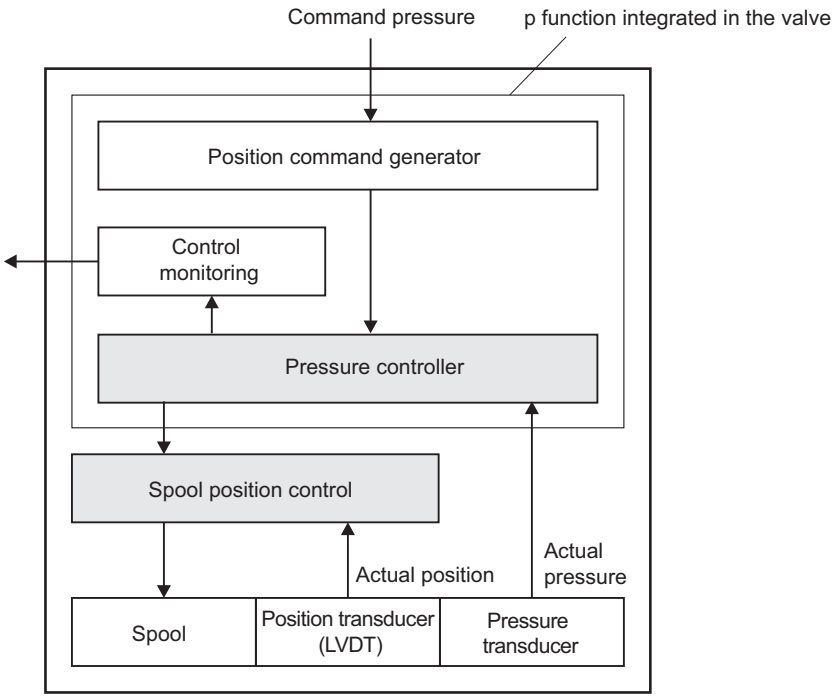


Fig. 4: Pressure control (p-control) block diagram

In this operational mode the pressure in port A is controlled. The predefined command signal corresponds to a particular pressure in port A.

The command signal (command pressure for port A) is transmitted to the valve electronics. The pressure in port A is measured with a pressure transducer and transmitted to the valve electronics as the actual pressure. Deviations between the predefined command pressure and the pressure measured in port A are corrected. The valve electronics drive the linear force motor, which positions the spool accordingly. This process sets a specific flow, which results in a pressure change in port A. The controlled pressure follows the command signal proportionally.

The pressure command can be influenced by means of parameters in the valve software (e.g., ramps, scaling, limitation).
The pressure controller is designed as an extended PID controller. The parameters of the PID controller and of the integrated pressure transducer can be set or interrogated via the service or field bus interface in the valve software. Setting and interrogation can be performed for example with the Moog Valve and Pump Configuration Software.

a Chap. "3.3.5 Notes on the pressure controller control response", page 42
a Chap. "3.5 Configuration software", page 53
a Chap. "3.6 Moog Valve and Pump Configuration Software", page 54

Monitoring the pressure transducer drift

High pressure peaks in the hydraulic system can result in a drift of the valve's internal pressure transducer.
To monitor any possible drift of the valve's pressure transducer, we recommend that the pressure transducer be checked 3, 6 and 12 months after the valve is started up and thereafter at intervals of 6 months. This can be conducted for example using comparison measurements with a calibrated pressure gauge. If necessary, the internal pressure transducer must be recalibrated.
The pressure transducer can be influenced by means of parameters in the valve software. The parameters can be set or interrogated via the service or field bus interface in the valve software. Setting and interrogation can be performed for example with the Moog Valve and Pump Configuration Software.

3.3.1.3 Flow and pressure control (pQ-control)

Flow and pressure control (pQ-control)

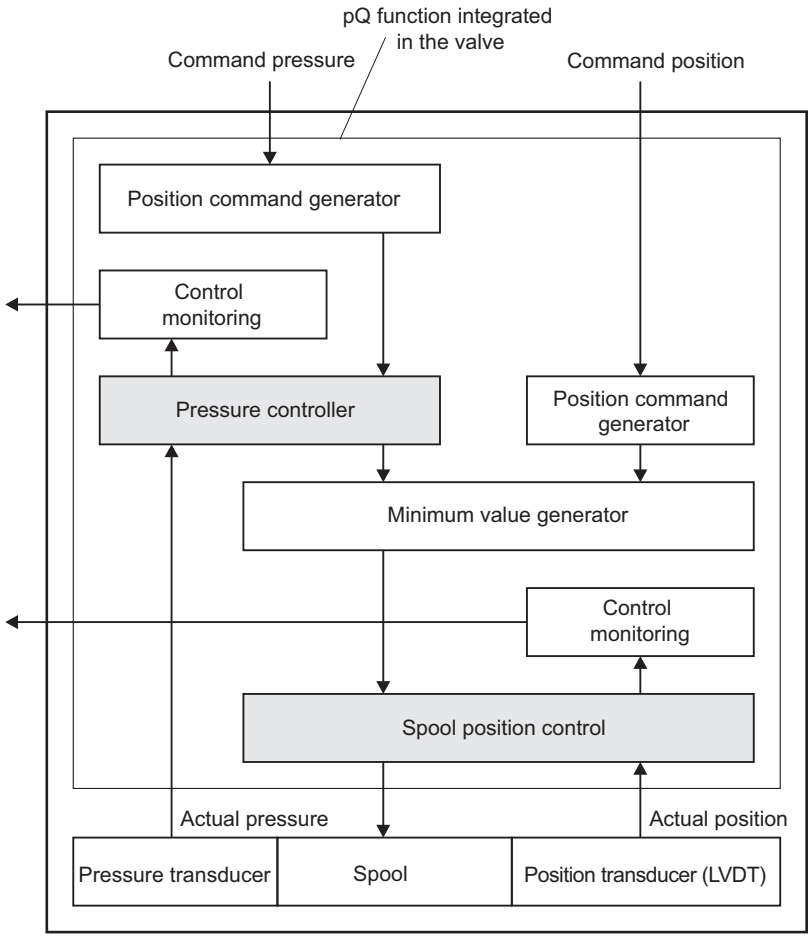


Fig. 5: Flow and pressure control (pQ-control) block diagram

This operational mode is a combination of flow and pressure control, where both command signals, i.e. the command position for the spool and the command pressure for port A, must be provided.

In pQ-control the position command calculated by the pressure controller is compared with the position command applied from an external source. The smaller of the two command signals is forwarded to the position control loop.

The following combinations are for example possible:

- Flow control with superimposed pressure limitation control
- Forced changeover from one operational mode to the other

3.3.2 Valve configurations and hydraulic symbols

Valve configurations

Depending on the model, the following valve configurations are possible:

- 2-way operation
  a Chap. "3.3.2.1 2-way and 2/2-way operation", page 38
- 3-way operation
  a Chap. "3.3.2.2 4-way and 3-way operation", page 39
- 4-way operation
  a Chap. "3.3.2.2 4-way and 3-way operation", page 39
- 5-way operation
  a Chap. "3.3.2.3 5-way operation", page 40
- 2/2-way operation
  a Chap. "3.3.2.1 2-way and 2/2-way operation", page 38

3.3.2.1 2-way and 2/2-way operation

2-way and 2/2-way operation

Hydraulic symbols of the valves D941K to D945K:
a Chap. " Technical data for D941K to D945K, overview", page 162

Fail-safe functions:
a Chap. "3.2.1.1 Valves with fail-safe functions F, D and M", page 28

With 2-way and 2/2x2-way operation the valves can be used to control the flow in one direction (used as throttle valves).

With 2/2x2-way operation the valve can be used in 2-way applications for greater flows.
It is necessary to connect ports P with B and A with T externally for this purpose.
a Chap. " Technical data for D941K to D945K, overview", page 162

The flow directions that are depicted under "Way functions and hydraulic symbols" in the technical data of the corresponding valve must be adhered to.

For the 2/2-way function, the connections X and Y must always be closed.
a Chap. "3.3.3.1 Pilot pressure port X", page 41
a Chap. "3.3.3.2 Leakage port Y", page 41

3.3.2.2 4-way and 3-way operation

4-way- and 3-way function (Fail-Safe-Function M and W)

Hydraulic symbols of the valves D941K to D945K:
a Chap. " Technical data for D941K to D945K, overview", page 162

Fail-safe functions:
a Chap. "3.2.1.1 Valves with fail-safe functions F, D and M", page 28
a Chap. "3.2.1.2 Valves with fail-safe functions H and K", page 29

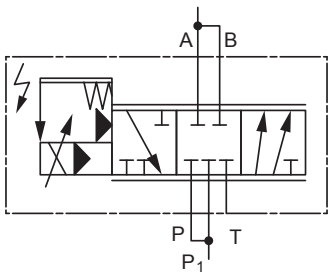
With 4-way operation the valves can be used to control the flow in ports A and B (used as throttle valves).

Port A or B must be closed in order to obtain 3-way operation.

The flow directions that are depicted under "Way functions and hydraulic symbols" in the technical data of the corresponding valve must be adhered to.
For D941 valves with a 4-way design and with Q_N > 60 l/min, the second tank port T_1 is required.
Information about whether the valve is delivered with externally or internally-connected leakage connection Y and whether leakage connection Y must be used:
a Chap. "3.3.3.2 Leakage port Y", page 41

3.3.2.3 5-way operation

5-way operation (fail-safe function F)



Example NG10

Fig. 6: 5-way operation with mechanical fail-safe function F (hydraulic symbol)

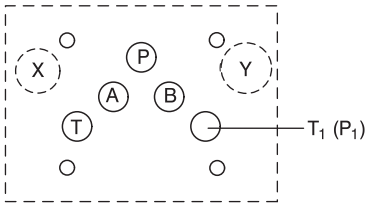
Hydraulic symbols of the D941K valve:
a Chap. "11.3 Technical data D941K – ISO 4401-05/NG10", page 174

Fail-safe functions:
a Chap. "3.2.1.1 Valves with fail-safe functions F, D and M", page 28
a Chap. "3.2.1.2 Valves with fail-safe functions H and K", page 29

The streaming directions that are depicted under "Way functions and hydraulic symbols" in the technical data of the corresponding valve must be adhered to.
Information about whether the valve is delivered with externally or internally-connected leakage connection Y and whether leakage connection Y must be used:
a Chap. "3.3.3.2 Leakage port Y", page 41

CAUTION

Danger of personal injury and damage to property!
For the D941K valves in the 5-way version type B80..., T_1 becomes P_1



3.3.3 Control type ports X and Y

3.3.3.1 Pilot pressure port X

Pilot pressure port X

If the system pressure is subject to heavy fluctuations, external actuation via pilot pressure port X delivers better control precision.

The valve can be supplied with either an externally or an internally connected pilot pressure port X.
When the valve is ordered, it is specified how this connection is made.
Whether the pilot pressure connection X is used can be read from the 7th digit of the variant designation.
a Chap. "11.1 Nameplates", Digit 7, Hydraulic control type, Pilot pressure port X and leakage port Y, page 170

3.3.3.2 Leakage port Y

Leakage port Y

The leakage port Y is present in all series of the D94xK type series; it must be used in the following cases:

- always with 2/2x2-way operation
- if high pressure peaks occur in the tank connection T (e.g. caused by other switchable valves in the hydraulic circuit) - without use of the leakage connection Y, they will cause damage to the valve.
  The maximum permissible values are specified under "Hydraulic data" in the technical data for the corresponding valve:
  a Chap. " Technical data for D941K to D945K, overview", page 162

The valve can be supplied with either an externally or an internally connected pilot pressure port Y.
When the valve is ordered, it is specified how this connection is made.
Whether the pilot pressure connection Y is used can be read from the 7th digit of the variant designation.
a Chap. "11.1 Nameplates", Digit 7, Hydraulic control type, Pilot pressure port X and leakage port Y, page 170

3.3.3.3 Pilot identification

Pilot identification

The pilot identification, i.e. the 7th position in the valve type designation, indicates whether pilot pressure port X and leakage port Y are internally or externally connected.

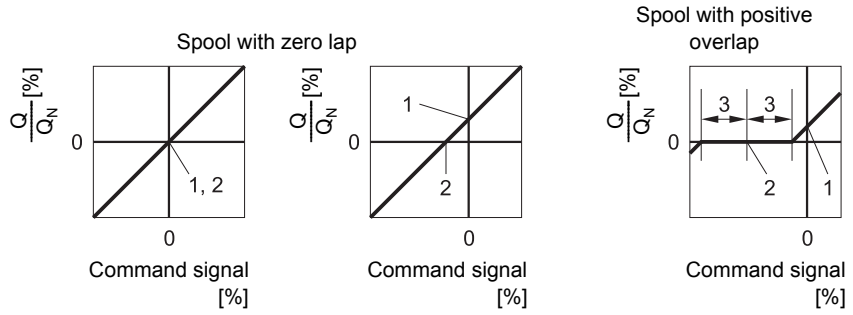
Type designation:
a Chap. "11.1 Nameplates", Digit 7, Hydraulic control type, Pilot pressure port X and leakage port Y, page 170

3.3.4 Electrical and hydraulic zero positions

The hydraulic zero position of the spool is not necessarily identical to the electrical zero position.

Electrical and hydraulic zero positions of the spool

The electrical zero position of the spool is set if the command signal input for the spool position is equal to zero.
The hydraulic zero position is the position of the spool in which the pressures, when the spool is symmetrical, are equal in the two sealed control ports.
The hydraulic zero position is model-dependent.



Item	Designation
1	Electrical zero position of the spool
2	Hydraulic zero position of the spool
3	Spool overlap

Fig. 7: Examples of the electrical and hydraulic zero positions of different spools in the flow signal characteristic curve

3.3.5 Notes on the pressure controller control response

Notes on the pressure controller control response

The controlled system is essentially influenced by:

- Rated flow Q_N
- Actual pressure difference Δp per control land
- Load stiffness
- The fluid volume connected with port A and to be controlled

Depending on differences in machine construction (such as volume, pipework, branching, accumulators.), different pressure controller configurations may be required in pressure control.
The pressure controller configurations can be set or interrogated via the service or field bus interface in the valve software.
Setting and interrogation can be performed for example with the Moog Valve and Pump Configuration Software.
Up to 16 pressure controller configurations can be stored and activated during operation.
a Chap. "3.6 Moog Valve and Pump Configuration Software", page 54

3.4 Control

Activation of the Valve Command

Valves without field bus interfaces must be commanded with an analog signal(s) via connector X1.
Valves with field bus interfaces can be controlled either with analog command signals via connector X1 or with digital signals via the field bus interface (connectors X3 and X4).
⇨ Chap. "3.1.6 Signal interfaces", page 24
a Chap. "3.4.1 Signal types for set-point and actual value", page 44

DANGER

Danger!
Danger due to electric shock.
- Only use SELV/PELV power supplies to supply the valve.

3.4.1 Signal types for set-point and actual value

Signal types for analog set-point value input and actual value output

Valves without field bus interfaces must be commanded with an analog signal(s) via connector X1.
Depending on the variant, various signal types can be configured for the analog flow function input signal (input) and for the analog spool position signal (actual value output) applied to the X1 connector.
a Tab. 7, page 45

The signal type can be set via the service or fieldbus interface in the valve software. Setting and interrogation can be performed for example with the Moog Valve and Pump Configuration Software.
a Chap. "3.6 Moog Valve and Pump Configuration Software", page 54

Benefits of the different signal types for analog command inputs

Signal types for command signal	Benefits
±10 V	Simple measurement of the signal, e.g. with an oscilloscope
±10 mA	In contrast to the 4–20 mA signal type, less power is required with low command signals;
4 to 20 mA	Detection of fault in the electrical line and large transmission lengths are possible

Tab. 6: Benefits of the different signal types for analog command inputs

It is necessary when ordering the valve to establish which signal type for the analog command inputs is to be set in the valve on delivery.
Which signal type has been set in the valve on delivery can be ascertained from the signal type identification, i.e. the 10th position in the type designation.
a Chap. "11.1 Nameplates", Digit 10, Command signal for 100 % spool stroke, page 170
Which signal type is currently set can be ascertained for example with the Moog Valve and Pump Configuration Software.

All current and voltage inputs are floating but can be connected to ground (single-ended) by means of external wiring.

Basically, activation of the command inputs with differential signals is to be preferred. If the command signal cannot be transmitted differentially, the reference point of the command input at the valve must be connected to ground (GND).
a Chap. "7.14.1 Single-ended command signals", page 109

Because current inputs have a lower input resistance than voltage inputs and are therefore less prone to interference, a current signal is preferable to a voltage signal.

Pin assignment of connector X1:
a Chap. "7.4.1 Pin assignment of connector X1", page 76

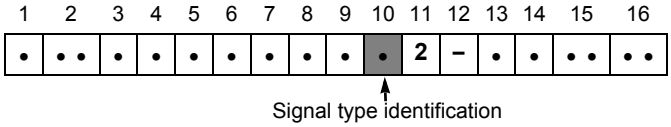
Configuration: a Chap. "8.3 Configuration of the valves", page 135

3.4.1.1 Signal type identification

Signal type identification

The signal type identification, i.e. the 10th position in the valve type designation, indicates which signal type for the command inputs is set in the valve when it is delivered.

The signal type of the command signal input applies in combination with the signal type of the spool position signal (actual value output).



Version	Command signals for 100 % spool stroke	
	Command signal (X1, input contacts 1 and 2)	**Stroke position signal** (X1, output contacts 4 and 7)
D	±10 V	2–10 V
E	4–20 mA	4–20 mA
M	±10 V	4–20 mA
X	±10 mA	4–20 mA
9	Fieldbus	Fieldbus
Y	Others on request.	

Tab. 7: Signal types command value and spool position signal in the type designation

The analog command signal I_{in} or U_{in} is the flow command value input.
The stroke position signal (actual output value) I_{out} or U_{out} is proportional to the mechanical position of the spool.

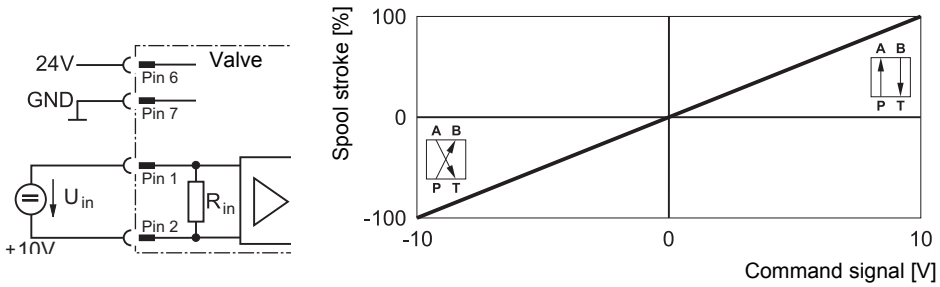
a Chap. "7 Electrical connection", page 68

The type designation and the signal type indicate the valve's delivery status.
By changing the valve configuration, it is possible to change the valve in such a way that it no longer conforms to this status.
Which signal type is currently set can be ascertained for example with the Moog Valve and Pump Configuration Software.

Type designation:
a Chap. "11.1 Nameplates", Digit 10, Command signal for 100 % spool stroke, page 170

3.4.1.2 Flow control command inputs

Signal type for the command input: ±10 mA



Floating flow control command input ±10 V

Fig. 8: Floating flow control command input ±10 V (circuit and characteristic curve)

The spool stroke is proportional to the input voltage U_{in}.

U_{in} = 10 V	100 % spool stroke, valve opening: P→A and B→T
U_{in} = 0 V	Spool in electrical zero position
U_{in} = -10 V	100 % spool stroke, valve opening: P→B and A→T

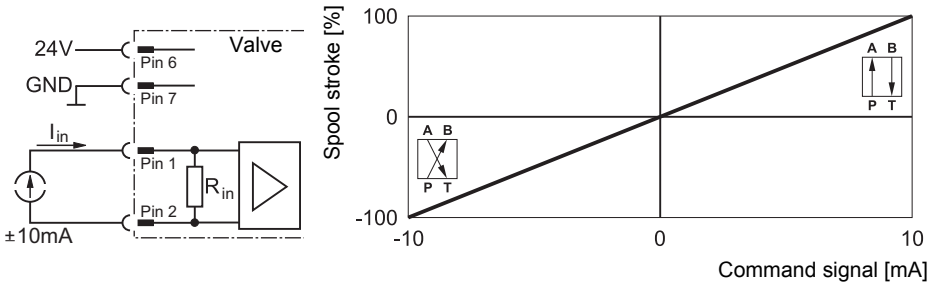
CAUTION

Danger of personal injury and damage to property!
The potential difference of each input to GND must be between -15 V and 32 V.

- Only use SELV/PELV power supplies.
- Heed the correct dimensioning of the cables.

If there is no differential command input source available, the reference point of the command inputs must be connected to 0 V of the command input source (GND).
The operating direction of the command signal can be altered by modifying the parameters of the valve software.

Signal type for the command input: ±10 V



Floating flow control command input ±10 mA

Fig. 9: Floating flow control command input ±10 mA (circuit and characteristic curve)

The spool stroke is proportional to the input current I_{in}.

I_{in} = 10 mA	100 % spool stroke, valve opening: P→A and B→T
I_{in} = 0 mA	Spool in electrical zero position
I_{in} = - 10 mA	100 % spool stroke, valve opening: P→B and A→T

CAUTION

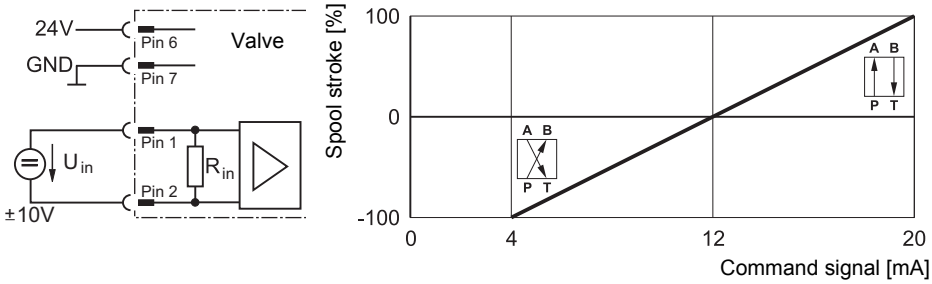
Risk of valve electronic damage!
The input current I_{in} of the command inputs with current input signal must be between -25 mA and 25 mA!
Voltage levels in excess of 5 V may cause the destruction of the integrated valve electronics.
- Only use SELV/PELV power supplies.
- Heed the correct dimensioning of the cables.

CAUTION

Danger of personal injury and damage to property!
The potential difference of each input to GND must be between -15 V and 32 V.
- Only use SELV/PELV power supplies.
- Heed the correct dimensioning of the cables.

If there is no floating command input source available, the reference point of the command inputs must be connected to 0 V of the command input source (GND).
The operating direction of the command signal can be altered by modifying the parameters of the valve software.

Signal type for the command input: 4–20 mA



Floating flow control command input 4–20 mA

Fig. 10: Floating flow control command input 4–20 mA (circuit and characteristic curve)

The spool stroke is proportional to the input current Iin.

I_{in} = 20 mA	100 % spool stroke, valve opening: P→A and B→T
I_{in} = 12 mA	Spool in electrical zero position
I_{in} = 4 mA	100 % spool stroke, valve opening: P→B and A→T

CAUTION

Risk of valve electronic damage!
The input current I_{in} of the command inputs with current input signal must be between -25 mA and 25 mA!
Voltage levels in excess of 5 V may cause the destruction of the integrated valve electronics.
- Only use SELV/PELV power supplies.
- Heed the correct dimensioning of the cables.

CAUTION

Danger of personal injury and damage to property!
In the signal range 4–20 mA command signals I_{in} < 3 mA (e.g. due to a faulty electric cable) indicate a fault.

- The valve response to this fault can be set and activated via the service or fieldbus interface in the valve software. Setting and activation can be performed for example with the Moog Valve and Pump Configuration Software.
- Examine the connection cables for defects.

CAUTION

Danger of personal injury and damage to property!
The potential difference of each input to GND must be between -15 V and 32 V.

- Only use SELV/PELV power supplies.
- Heed the correct dimensioning of the cables.

If there is no floating command input source available, the reference point of the command inputs must be connected to 0 V of the command input source (GND).
The operating direction of the command signal can be altered by modifying the parameters of the valve software.

3.4.1.3 pressure control command inputs

Signal type for the command input: 0–10 V

Differential pressure control command input 0–10 V

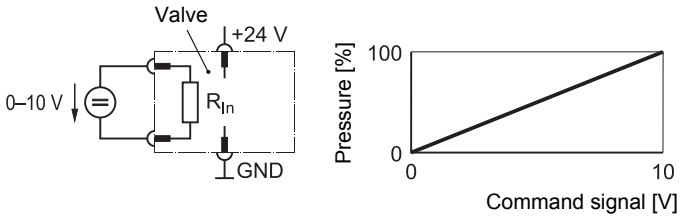


Fig. 11: Differential flow control command input 0–10 V (circuit and characteristic curve)

In the case of this signal type, the input is configured as a differential voltage input with a 0–10 V input range.
The pressure in control port A is proportional to the input voltage U_{in}.

U_{In} = 10 V 100 % pressure in control port A

U_{In} = 0 V 0 % pressure in control port A

The differential input resistance R_{In} is 20 kΩ.
The input resistance referenced to supply zero is approx. 150 kΩ.

CAUTION

Danger of personal injury and damage to property!
The potential difference of each input to GND must be between -15 V and 32 V.

- Only use SELV/PELV power supplies.
- Heed the correct dimensioning of the cables.

If there is no differential command input source available, the reference point of the command inputs must be connected to 0 V of the command input source (GND).

Signal type for the command input: 0–10 mA

Differential pressure control command input 0–10 mA

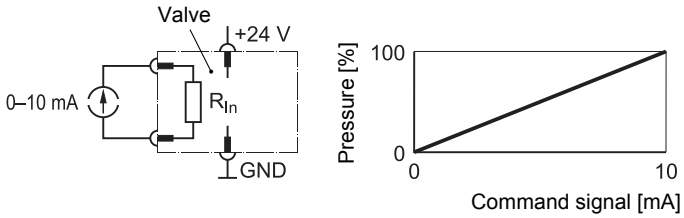


Fig. 12: Differential flow control command input 0–10 mA (circuit and characteristic curve)

In the case of this signal type, the input is configured as a differential voltage input with a 0–10 mA input range.
The input current to be measured I_{In} is directed via the two input pins to an internal shunt.
The pressure in control port A is proportional to the input current I_{in}.

I_{In} = 10 mA 100 % pressure in control port A

I_{In} = 0 mA 0 % pressure in control port A

The differential input resistance R_{In} is 200 Ω.
The input resistance referenced to GND is approx. 150 kΩ.

CAUTION

Danger of personal injury and damage to property!
The potential difference of each input to GND must be between -15 V and 32 V.
- Only use SELV/PELV power supplies.
- Heed the correct dimensioning of the cables.

CAUTION

Risk of valve electronic damage!
The input current must be between -25 mA and 25 mA. Input currents outside this permissible range will destroy the input.
- Only use SELV/PELV power supplies.
- Heed the correct dimensioning of the cables.

If there is no differential command input source available, the reference point of the command inputs must be connected to 0 V of the command input source (GND).

Signal type for the command input: 4–20 mA

Differential pressure control command input 4–20 mA

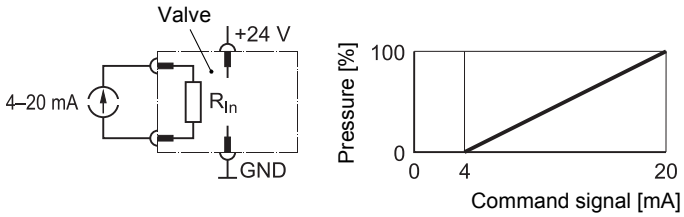


Fig. 13: Differential flow control command input 4–20 mA (circuit and characteristic curve)

In the case of this signal type, the input is configured as a differential voltage input with a 4–20 V input range.
The input current to be measured I_{In} is directed via the two input pins to an internal shunt.
The pressure in control port A is proportional to the input current I_{in}.

I_{In} = 20 mA 100 % pressure in control port A

I_{In} = 4 mA 0 % pressure in control port A

The differential input resistance R_{In} is 200 Ω.
The input resistance referenced to GND is approx. 150 kΩ.

CAUTION

Danger of personal injury and damage to property!
In the signal range 4–20 mA command signals I_{in} < 3 mA (e.g. due to a faulty electric cable) indicate a fault.

- The valve response to this fault can be set and activated via the service or fieldbus interface in the valve software. Setting and activation can be performed for example with the Moog Valve and Pump Configuration Software.
- Examine the connection cables for defects.

CAUTION

Danger of personal injury and damage to property!
For the floating analog inputs of connector X1, the potential difference (referenced to supply zero) must be between -15 V and 32 V.

- Only use SELV/PELV power supplies.
- Heed the correct dimensioning of the cables.

CAUTION

Risk of valve electronic damage!
The input current must be between -25 mA and 25 mA. Input currents outside this permissible range will destroy the input.

- Only use SELV/PELV power supplies.
- Heed the correct dimensioning of the cables.

3.4.2 Analog actual value output

Analog actual value output

The valves have an analog actual value output:
The stroke position signal I_{out} or U_{out} (X1, contact 4) specifies the measured actual value of the position of the spool in the flow function.
The reference point for the analog output is GND (X1, contact 7).

Stroke position signal (X1, contacts 4 and 7) 4–20 mA or 2–10 V

The entire spool stroke corresponds to 4 to 20 mA or 2 to 10 V.

I_{out} = 20 mA	U_{out} = 10 V	100 % spool stroke, Valve opening: P→A and B→T
I_{out} = 12 mA	U_{out} = 6 V	Spool in electrical zero position
I_{out} = 4 mA	U_{out} = 2 V	100 % spool stroke, Valve opening: P→B and A→T

External detection of electrical cable faults can be realized with the 4–20 mA and 2-10 V analog spool position signal.

I_{out} = 0 mA or U_{out} = 0 V suggests a cable break.

The actual value output 4–20 mA and 2–10 V is short-circuit-proof.

Signal types command signal and spool position signal in the type designation:
a Tab. 7, page 45

Pin assignment of connector X1:
a Chap. "7.4.1 Pin assignment of connector X1", page 76

Conversion of actual value output signals Iout from 4–20 mA into 2–10 V:
a Chap. "7.14.2 Conversion of actual value output signals Iout", page 110
The 4–20 mA output can be transformed using this switch into 2–10 V or the valve can be ordered directly with a 2–10 V output.

3.4.3 Digital enable input

Enable input

The valves have a digital enable input.

Switching of the valve to standby or fail-safe state can also be triggered by corresponding signals at the enable input of connector X1:

- Signals between 8.5 V and 32 V based on GND at the enable input switch the valve to standby.
- Signals lower than 6.5 V at the enable input switch the valve to fail-safe state.

Pin assignment of connector X1:
a Chap. "7.4.1 Pin assignment of connector X1", page 76

Fail-safe state of the valves:
a Chap. "3.2 Safety function/fail-safe", page 27

3.5 Configuration software

Configuration software

By changing the configuration of the software in the valve, the functionality of the valve can be influenced using the external configuration software.

a Chap. "8.3 Configuration of the valves", page 135

CAUTION

Risk of personal injuries!
In case of malfunctions of the valve due to incorrectly-configured software, there is a danger due to uncontrolled movements of the higher-level machine and destruction in the area around the higher-level machine.

- When changing the configuration of the valve, make sure that the functionality of the valve matches that described in the operating instructions and the planned functionality.

The valve software is an integral part of the valve and cannot be altered, copied or replaced by the user.

Configuration of the valves

Many of the functions made available by the valve software can be configured by the user by modifying parameters. For this purpose, the desired parameters must be transferred to the valve via the service or field bus interface. Parameters can basically be modified by each fieldbus node, for example also by the machine controller.

If the valve is incorporated in a fieldbus, the parameters can be transferred to the valve each time the system is powered up.
This ensures that the valve always receives the correct configuration of the valve software.

The Moog Valve and Pump Configuration Software is available as an accessory to simplify start-up, diagnosis and configuration of the valves.
a Chap. "3.6 Moog Valve and Pump Configuration Software", page 54

3.6 Moog Valve and Pump Configuration Software

Moog Valve and Pump Configuration Software

The *Moog Valve and Pump Configuration Software* is a Microsoft® Windows® application enabling fast and convenient start-up, diagnosis and configuration of the valves.
The Moog Valve and Pump Configuration Software communicates with the valves via the service or CAN bus interface. A PC with a suitable interface card is required for this purposes.

The Moog Valve and Pump Configuration Software offers the following functions:

- Transfer of data between PC and valves
- Storage of the current valve settings on the PC
- Activation of the valves with graphic software control elements
- Graphic representation of status information, command signals and actual values as well as characteristic curves for the valves
- Recording and visualization of the system parameters with the integrated data logger and the integrated oscilloscope function

The Moog Valve and Pump Configuration Software is available as an accessory.
a Chap. "12.1 Accessories for valves in the D94xK type series", page 232

3.7 Nameplate

See "Technical data":
a Chap. "11.1 Nameplates", page 164
a Chap. "11.1.1 Model number and type designation", page 166
a Chap. "11.1.2 LSS address", page 173
a Chap. "11.1.3 Data matrix code", page 173

4 Characteristic curves

All characteristic curves are type-specific.

Flow rate characteristic curves, step response and frequency response characteristic curves:
a Chap. "11 Technical Data", page 162

4.1 Flow diagram (4-way operation)

Flow diagram (4-way operation)

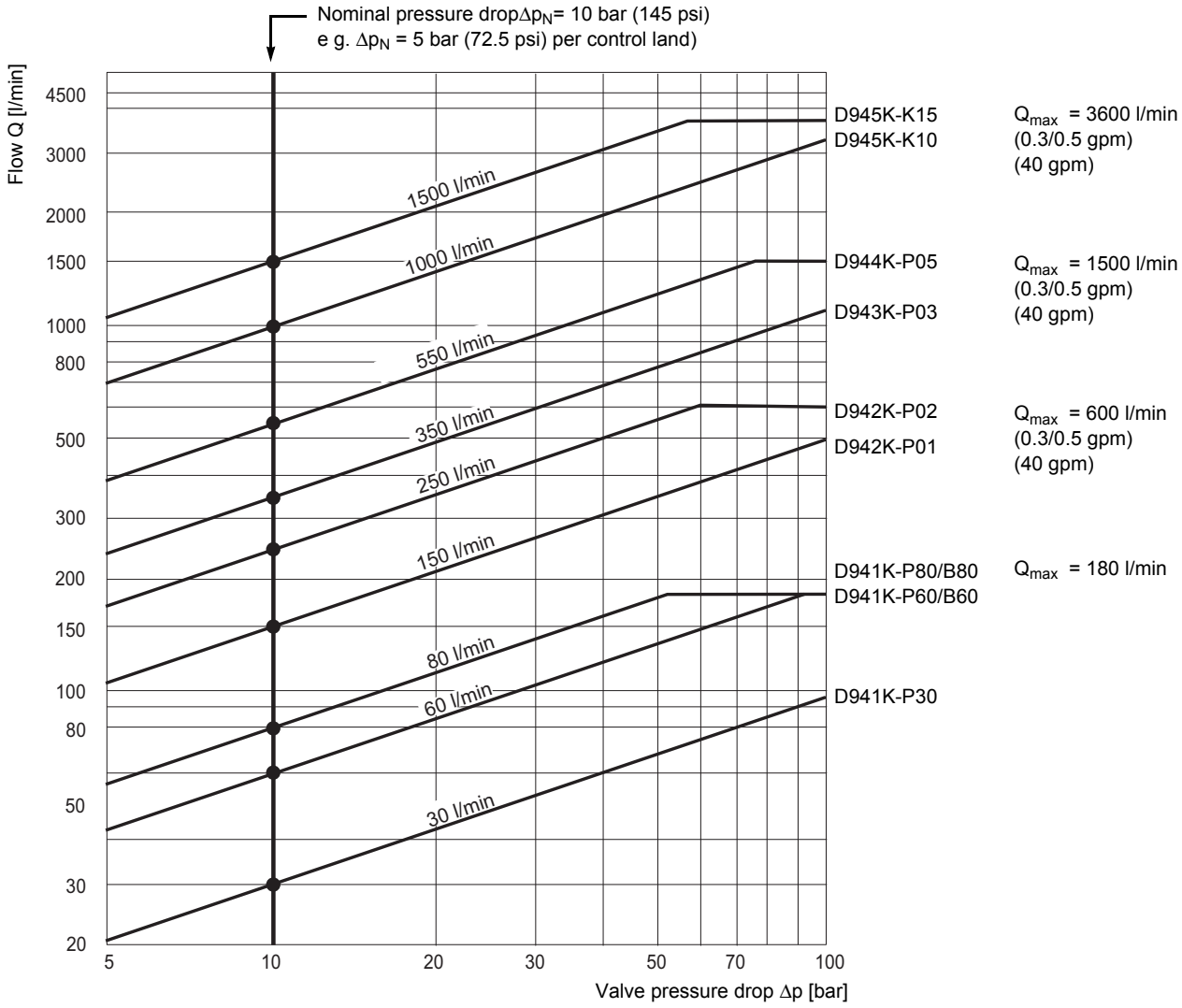


Fig. 14: Flow diagram (4-way operation) D941K to D945K

The flow rate to be set depends not only on the position of the spool, but also on the pressure difference Δ p at the individual control lands.

Formula for calculating the flow Q

A flow control command signal of 100 % produces with a rated pressure difference of Δp_N = 5 bar (72.5 psi) per control land the rated flow-Q_N. If the pressure difference is altered, so the flow Q also changes with a constant command signal in accordance with the following formula:

$$Q = Q_N \cdot \sqrt{\frac{\Delta p}{\Delta p_N}}$$

Q [l/min] : actual flow
Q_N [l/min] : rated flow
Δp [bar/psi] : Actual pressure difference per control land
Δp_N [bar/psi] : Rated pressure difference Δp_N = 5 bar (72.5 psi) per control land

To avoid cavitation, the flow speed of the actual flow Q calculated in this way at ports (P, A, B, X, Y and T) must not be too great.

The actual flow Q calculated thus must not exceed a mean flow velocity of 30 m/s (96.54 ft/s) at ports P, A, B, X, Y and T.

4.2 Flow signal characteristic curve

The flow-signal characteristic curves are type-specific.
a Chap. "11 Technical Data", page 162

As an example, a linear characteristic curve of a D941K (cf. Fig. 17, P30) is depicted here.

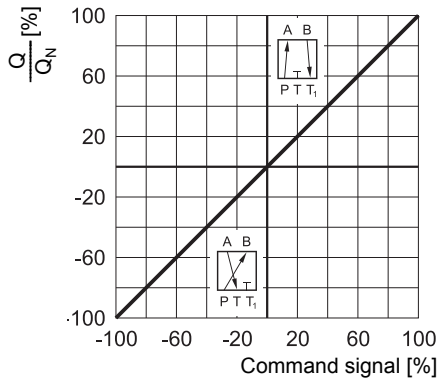


Fig. 15: Flow signal characteristic curve with equal electrical and hydraulic zero positions

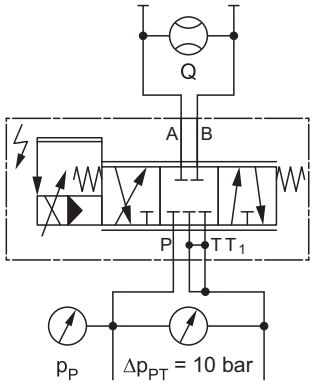


Fig. 16: Design for measuring the flow signal characteristic curve

Flow-signal characteristic D941K

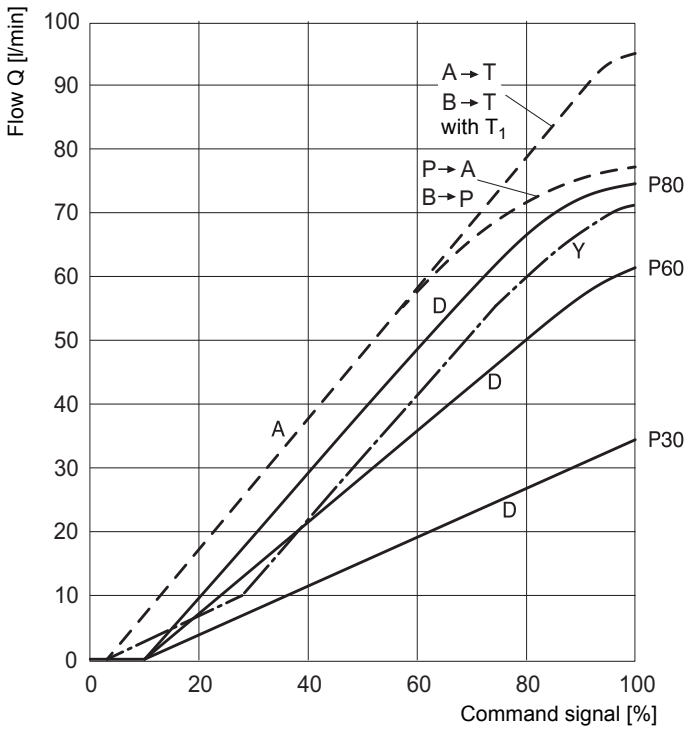


Fig. 17: Valve D941K, flow-signal characteristic

4.3 Pressure signal characteristic curves [1)]

4.3.1 Valves with controlled spool position

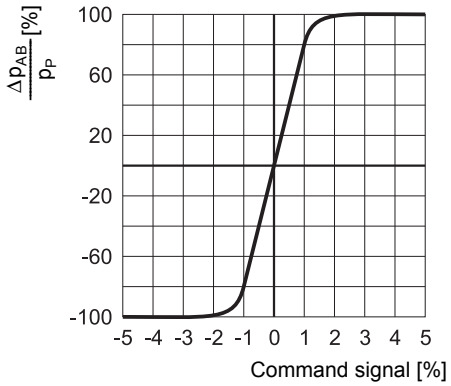


Fig. 18: Pressure signal characteristic curve of the valves with controlled spool position and zero lap

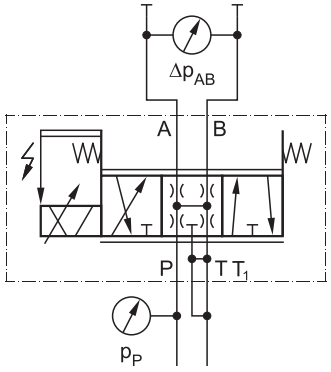


Fig. 19: Design for measuring the pressure signal characteristic curve on valves with a controlled spool position (example: D941K)

Pressure signal characteristic curve of the valves with controlled spool position and zero lap

4.3.2 Pressure control valves

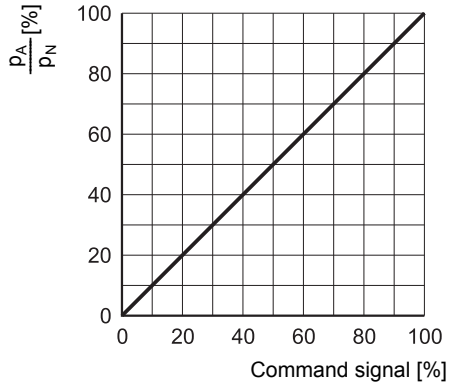


Fig. 20: Pressure characteristic curve of the pressure control valves

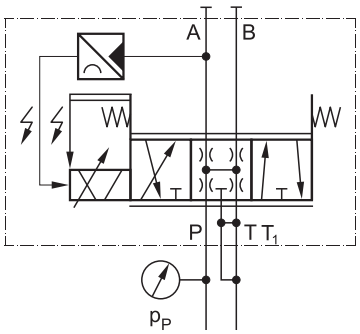


Fig. 21: Design for measuring the pressure signal characteristic curve on pressure control valves (example: D941K)

Pressure characteristic curve of the pressure control valves

[1)] Typical characteristic curve
(measured at operating pressure p_P = 140 bar, viscosity of the hydraulic fluid ν = 32 mm^2/s and temperature of the hydraulic fluid T = 40 °C)

5 Transportation and Storage

Safety instructions: Transportation and Storage

WARNING

Danger of property damage!
In order to ensure perfect, reliable, and safe operation of the valves, heed the following:

- The valves must be protected in particular to prevent entry of dust and moisture.
- The permissible ambient conditions for the valves must be maintained at all times also in the case of transportation and storage.
- a Chap. "11 Technical Data", page 162.

WARNING

Danger of explosion!
During transport and storage, cables on the valve, cable glands, screw plugs, and plug connectors must not be damaged.

- The valve must not be started up with damaged cables, connectors or screw plugs, and it must be sent to us or to one of our authorized service centers immediately.

CAUTION

Risk of injury!
To prevent injuries or other damaging influences on health, suitable protective measures must be taken if necessary prior to and when carrying out any work on the valves or the machine, such as mounting or removing, electrical or hydraulic connection, troubleshooting or servicing, and when handling the valves, accessories, tools or hydraulic fluids.

- a Chap. "2.2 Occupational safety and health", page 15

CAUTION

Risk of damage due to dirt and moisture!
This is the only way of adequately protecting the valves against the penetration of dirt and moisture and protecting the gaskets/seals against the effects of ozone and UV.

- The valves must not be transported or stored without their shipping plate fitted.
- The valve shipping plate may only be removed from the valve hydraulic ports directly prior to mounting and must be reinstalled directly after the valve has been removed.
- The shipping plate and the associated fastening elements (screws and nuts) must be kept for later use, e.g. during transportation.

CAUTION

Risk of damage due to condensation!
Due to temperature fluctuations during transport and storage of the valves, humidity may condense.
- Wait with the start-up of the valves until the valves have reached the ambient temperature

CAUTION

Risk of damage!
The plugs, connectors, and connection cables of the valves may not be used for other purposes, such as for stepping on or as transport holders.

CAUTION

Danger of personal injury and damage to property!
Warranty and liability claims for personal injury and damage to property are excluded if they are caused by valves, spare parts or accessories having been stored or transported outside their original packaging.
- Store and transport valves, spare parts, and accessories only in properly-sealed original packaging.
- a Chap. "1.8 Warranty and liability", page 11.

CAUTION

Risk of damage!
Improper handling during transport or storage of the valves, spare parts, and accessories can cause damage to the original packaging and to the contents.
- After transporting or storing valves, spare parts and accessories, check the original packaging and contents for possible damage.
- Do not start up the system if the packaging or contents show signs of damage. In this case, notify us or the supplier responsible immediately.
- In the event of transportation damage, store the damaged packaging so that if necessary damages can be claimed from the transport contractor.

5.1 Checking/unpacking a delivery

Procedure for checking/ unpacking a delivery

Procedure:

1. Check whether the packaging is damaged.
2. Remove packaging.
3. Keep damaged packaging so that damage claims can be lodged against the transport company.
   We recommend that you keep the original packaging for later transportation or storage operations.
4. Dispose of packaging material that is no longer needed according to the local specific disposal regulations and environmental protection provisions.
5. Check whether the contents of the packaging are damaged.
6. In case of damaged packaging or damaged content, inform us and the responsible supplier immediately.
7. Check whether the delivery matches the order and the delivery note.
8. In case of incorrect or incomplete delivery, inform us or the responsible supplier immediately.

5.2 Scope of delivery of the valve

Scope of delivery of the valve

The scope of delivery of the valve consists of:

- Valve with mounted oilproof shipping plate at the hydraulic port
- For D941K:
  - 6 O-rings ID 12.4 x dia. 1.8 [mm] (0.49 x 0.07 in) (0.61 x 0.07 in) for ports A, B, P, T1 and X
  - 1 O-ring ID 15.6 x dia. 1.8 [mm] (0.61 x 0.07 in) for port Y
- For D942K:
  - 4 O-rings ID 21.89 x dia. 2.6 [mm] (0.86 x 0.10 in) (0.61 x 0.07 in) for ports A, B, P and T
  - 2 O-rings ID 10.82 x dia. 1.8 [mm] (0.43 x 0.07 in) for ports X and Y
- For D943K and D944K:
  - 4 O-rings ID 34.60 x dia. 2.6 [mm] (1.36 x 0.10 in) (0.61 x 0.07 in) for ports A, B, P and T
  - 2 O-rings ID 20.92 x dia. 2.6 [mm] (0.82 x 0.10 in) for ports X and Y
- For D945K:
  - 4 O-rings ID 53.60 x dia. 3.5 [mm] (2.11 x 0.14 in) (0.61 x 0.07 in) for ports A, B, P and T
  - 2 O-rings ID 14.00 x dia. 1.8 [mm] (0.55 x 0.07 in) for ports X and Y
- User manual D94xK type series

5.3 Storage

Effects of long-term Storage

The following effects may occur in the course of long-term storage:

- Gasket/seal materials become brittle, possibly resulting in leaks
- Hydraulic fluid becomes gummy, possibly resulting in friction.

In order to avoid possible resulting impairments or damage, we recommend that the valve, after a period of storage or operation of more than 5 years, be inspected by us or one of our authorized service centers.

6 Mounting and Connection to the Hydraulic System

Safety instructions: Mounting and Connection to the Hydraulic System

DANGER

Danger of injury due to electric voltage and unexpected movements!
Work on machines that are not shut down presents a danger to life and limb. Work such as mounting or removal, electrical or hydraulic connection, troubleshooting or servicing may only be performed on machines and valves that are shut down.

- Make sure to shut the machine down and switch it off.
- Make sure that the drive motor cannot be switched on.
- For this purpose, switch off the supply voltage as well as that of connected peripherals, such as externally powered transducers or programming units.
- Make sure that all power-transmitting components and connections (electrical and hydraulic) are switched off according to the manufacturer's instructions and secured against switching on again. If possible, remove the main fuse from the machine.
- Make sure that the machine is completely depressurized.

DANGER

Danger of poisoning and injury due to hydraulic fluid squirting out under pressure!
Contact with hydraulic fluids can damage your health (e.g. eye injuries, skin and tissue damage, poisoning in case of inhaling).

- Wear protective gloves and safety glasses.
- If hydraulic fluid gets into your eyes or on your skin, consult a doctor immediately.
- When handling hydraulic fluids, observe the safety provisions applicable to the hydraulic fluid used.

WARNING

Danger of explosion!
For mounting and connection to the hydraulic system, cables on the valve, cable glands, screw plugs, and plug connectors may not be damaged.

- The valve must not be started up with damaged cables, connectors or screw plugs, and it must be sent to us or to one of our authorized service centers immediately.

CAUTION

Risk of injury!
To prevent injuries or other damaging influences on health, suitable protective measures must be taken if necessary prior to and when carrying out any work on the valves or the machine, such as mounting or removing, electrical or hydraulic connection, troubleshooting or servicing, and when handling the valves, accessories, tools or hydraulic fluids.

- a Chap. "2.2 Occupational safety and health", page 15

CAUTION

Danger of personal injury and damage to property!
Working with and on the valves without the required basic mechanical, hydraulic, and electrical knowledge may cause injuries or parts may be damaged.

- Only properly qualified and authorized users may work with and on the valves.
- a Chap. "1.4 Selection and qualification of personnel", page 7

6.1 Dimensions (installation drawings)

The dimensions of the valves depend on the series
a Chap. "11 Technical Data", page 162

6.2 Mounting surface

6.2.1 Surface quality

Evenness and roughness of the mounting surface

Evenness as per EN ISO 1302:	< 0.01 mm (400 µin) over 100 mm (3.94 in)
Average roughness R_a according to EN ISO 1302:	< 0.8 µm (30 µin)

6.2.2 Holes in mounting surface

The details for the mounting surface depend on the series.

Holes in the mounting surfaces:
a Chap. "11 Technical Data", page 162

6.3 Mounting the valve

6.3.1 Tools and materials required

Tools and materials required for mounting the valves

The following tools and materials are required for mounting the valves:

- For removing the shipping plate:
  Wrench for hexagon socket head cap screws or regular screwdriver (only valve D941K) and, if necessary, wrench
- For mounting the valve
  Torque wrench for hexagon socket head cap screws
- Installation screws
- Replacement for O-rings of ports to be replaced if necessary.

Installation screws

The installation screws and the O-rings to be replaced if necessary are not included in the scope of delivery for the valves. They are available as an accessory.
a Chap. "12 Accessories, Spare Parts, and Tools", page 232
The wrench sizes of the hexagon socket cap head screws for mounting are type series-specific.
Details about the screws and their tightening torque:
a Tab. 8, page 65

Attachment screws

The fastening screws for the transport plates are type-specific. Details about fastening screws and their tightening torque:
a Chap. "12 Accessories, Spare Parts, and Tools", page 232

6.3.2 Specification for installation screws for the valves

Specification for installation screws for the valves

	Hexagon socket head cap screws as per EN ISO 4762 Quality class 10.9	Number required	Width across flats/ Tightening torque
D941K NG10	M6x40	4	WAF 5 11 Nm (8 lbf ft) ± 10 %
D942K NG16	M6x55 M10x60	2 4	WAF 5 11 Nm (8 lbf ft) ± 10 % WAF 8 54 Nm (40 lbf ft) ± 10 %
D943K and D944K NG25	M12x75	6	WAF 10 94 Nm (69 lbf ft) ± 10 %
D945K NG32	M20x90	6	WAF 17 460 Nm (339 lbf ft) ± 10 %

Tab. 8: Specification for installation screws for the valves

6.3.3 Procedure

Safety instructions: Mounting the valve

CAUTION

Danger of personal injury and damage to property!
The shipping plate attachment screws must not under any circumstances be used to mount the valve.

- Use only the installation screws specified here for mounting the valve.
- The fastening of the valve with unsuitable screws can be destroyed under pressure.

CAUTION

Risk of damage due to dirt and moisture!
This is the only way of adequately protecting the valves against the penetration of dirt and moisture and protecting the gaskets/ seals against the effects of ozone and UV.

- The valves must not be transported or stored without their shipping plate fitted.
- The valve shipping plate may only be removed from the valve hydraulic ports directly prior to mounting and must be reinstalled directly after the valve has been removed.
- The shipping plate and the associated fastening elements (screws and nuts) must be kept for later use, e.g. during transportation.

CAUTION

Danger of explosion and risk of damage due to overheating!
In order to prevent overheating of the valves.

- Mount the valves so that good ventilation is ensured.
- The maximum permissible temperatures of the respective temperature classes and the maximum permissible ambient temperature as well as the maximum permissible temperature of the hydraulic fluid may not be exceeded.
- a Chap. "1.3 Intended operation", page 5

CAUTION

Risk of damage!
Vibrations and shocks can damage the valve.

- Do not mount the valve directly on machine parts that are exposed to strong vibrations or sudden movement.
- On units that are moved in jerks and jolts, the movement direction of the spool should not be the same as the movement direction of the unit.a Chap. "11 Technical Data", page 162

CAUTION

Increased wear and functional faults!

The cleanliness of the connection and mounting surface influences the cleanliness and the life cycle of the valve. Soiling causes wear and functional faults.

- Make sure the valve is extremely clean.
- Install the valve dirt-free.
- Make sure that connections and attachments are clean.
- Do not use steel wool or cloths with lint for cleaning.
- Do not use any cleaning agents or methods that could attack the surfaces or the O-rings mechanically or chemically.

Mount the valves with venting screw in such a way that it can be vented.
The venting screw must point upwards.
a Chap. "8.5.1 Venting", page 140
a Fig. 1, page 19

Procedure for mounting the valve:

Procedure for mounting the valve

1. Clean the valve mounting and connecting surfaces.
   Check and if necessary correct the evenness and roughness of the mounting surface.
   a Chap. "6.2.1 Surface quality", page 64
2. Remove the shipping plate from the valve's hydraulic port.
   The shipping plate and the associated fastening elements (screws and nuts) must be kept for later use, e.g. during transportation.
3. Check that O-rings in the valve ports (P, A, B, X, Y and T) are present and for elasticity, integrity and correct seating.
   If necessary, install O-rings, replace or correct the seating.
4. Paying attention to the mounting pattern, place the valve on the mounting surface and align with the mounting bores.
5. Secure the valve. To do so, tighten the installation screws (hexagon socket head cap screws) free from distortion in diagonal sequence.
   Tightening torque::
   a Tab. 8, page 65

Due to the significant weight of the D945K valve, special measures must be taken during mounting and removal.
There are two eye bolts screwed into the D945K valve for lifting and transport.
Threaded holes are provided in the D943K and D944K valves, into which the eye bolts for lifting and transport can be screwed.

7 Electrical connection

7.1 Safety instructions for installation and maintenance

DANGER

Danger of explosion!
An explosion can be triggered by sparks when switching on the machine.

- Open connectors for the interface must absolutely be covered before start-up.
- The eXLink connectors from CEAG must be mounted according to the instructions in the operating instructions for the eXLink connectors.
- In the standard model with a screw plug, the service connector X10 is not permitted for use in a hazardous area.
- The service connector X10 in the standard model M8, 3-pin must be sealed with the original screw plug belonging to the valve before start-up.
- When mounting the screw plug for the service connector X10, make sure that the seal and the thread of the screw plug as well as the thread in the electronic housing of the valve are not damaged.
- In case of damage to the screw plug for the service connector X10 or the threads in the electronic housing, the valve must not be operated.
- Tightening torque for screw plug:
  a Chap. "3.1.3 Representative depiction of the valve", page 19

WARNING

Danger of explosion!
For the electrical connection of the valve, cables, cable glands, screw plugs, and connectors must not be damaged.

- The valve must not be started up with damaged cables, connectors or screw plugs, and it must be sent to us or to one of our authorized service centers immediately.

WARNING

Danger of explosion!
To guarantee safe operation in hazardous areas:

- The signal interfaces of the valve are implemented with explosion-proof connectors.
- For mounting and removal of the connectors as well as operation of the valve, the notes and instructions in the "Explosion-proof connectors eXLink, CEAG" operating instructions must absolutely be adhered to.

CAUTION

Danger of personal injury and damage to property from interchanged connections!
Interchanging connections causes unforeseeable movements of the machine and thus corresponding risks to people and equipment.

- When starting up valves on the field bus for the first time, we recommend that the component be operated in a depressurized state.
- Before connecting valves to the field bus, it is essential to complete the electrical and if necessary hydraulic connection of the component properly as described in the user manual.

CAUTION

Danger of personal and property damage due to defective accessories and defective spare parts!
Unsuitable or defective accessories or unsuitable or defective spare parts may cause damage, malfunctions or failure of the valve or the machine.

- Use only original accessories and original spare parts.

CAUTION

Danger of personal injury and damage to property!
Improperly laid connection cables can cause damage, malfunctions or failure of valves or the machine.

- Do not lay valve connection cables in the immediate vicinity of high-voltage cables or together with cables that switch inductive or capacitive loads.

CAUTION

Danger of personal injury and damage to property!
For the floating analog inputs of connector X1, the potential difference (referenced to supply zero) must be between -15 V and 32 V.

- Only use SELV/PELV power supplies.
- Heed the correct dimensioning of the cables.

CAUTION

Danger of personal injury and damage to property!
In the signal range 4–20 mA input currents < 3 mA can cause faulty reactions with digital valves.

- Examine the connection cables for defects.

CAUTION

Risk of valve electronic damage!
In the signal range 4–20 mA command signals Iin < 3 mA (e.g. due to a faulty electric cable) indicate a fault.
- The valve response to this fault can be set and activated via the service or field bus interface in the valve software. Setting and activation can be performed with the Moog Valve and Pump Configuration Software, for example.
- Examine the connection cables for defects.

CAUTION

Risk of valve electronic damage!
The input current must be between -25 mA and 25 mA. Input currents outside this permissible range will destroy the input.
- Only use SELV/PELV power supplies.
- Heed the correct dimensioning of the cables.

The valves described here must only be operated with external fuse protection. The information about the external fuse protection of the valves is included in Chapter 11.3 to 11.7.
a Tab. 37, page 176
a Tab. 38, page 187
a Tab. 39, page 198
a Tab. 40, page 209
a Tab. 41, page 220

7.1.1 Protective grounding and electrical shielding

DANGER

Danger of explosion in case of unsafe operation!
In order to create as small a potential difference in the machine as possible and guarantee safe operation of the machine, the equipotential bonding and protective conductor system for a machine in which the valves are to be used must be constructed according to EN 60204-1.
- Connect all elements of the machine to each other via equipotential bonding conductors.
- Connect all elements of the machine that have exposed metal surfaces to the protective conductor rail via protective conductors and equipotential bonding conductors.
- Connect all the protective conductors and the equipotential bonding conductor in the main cabinet via the protective conductor rail to the protective earth (PE) terminal.

Equipotential bonding / protective conductor system

DANGER

Danger to life!
This protective conductor is not a replacement for the normal equipotential bonding system.

- Connect all elements of the machine system with exposed metal surfaces to the protective conductor rail via protective conductors.

DANGER

Danger to life due to electric shock!
Very strong current can flow via the shield connection of the valve.

- Extreme caution is required since for some industrial applications, no good equipotential bonding can be implemented.
- An effective equipotential bonding system must be set up in compliance with EN 60204-1, Section 8.

DANGER

Danger to life!
People can be injured and property damaged through the operation of the valve with an unsafe power supply.

- Only use SELV/PELV power supplies as per EN 60204-1!

7.1.2 Moog Valve and Pump Configuration Software

CAUTION

Danger of personal injury and damage to property!
Improper handling of the Moog Valve and Pump Configuration Software causes malfunctions and thus corresponding risks to people and equipment.

- For safety reasons, the Moog Valve and Pump Configuration Software must not be used inside a machine for visualization purposes or as an operator terminal.

CAUTION

Danger of personal injury and damage to property!
It is not permitted to operate the Moog Valve and Pump Configuration Software on a fieldbus while the machine is running.
It is only permitted to activate valves via the Moog Valve and Pump Configuration Software if this does not cause any dangerous states in the machine and in its surroundings.

CAUTION

Danger of personal injury and damage to property!
Activating valves via the Moog Valve and Pump Configuration Software within a network can give rise to unforeseeable events if field bus communication takes place simultaneously between the machine control or other bus nodes!

- Deactivate the field bus communication for machine control and other bus nodes.

CAUTION

Danger of personal injury and damage to property!
Messages from the Moog Valve and Pump Configuration Software can also be received by other bus nodes. This may trigger unforeseeable events.

- Deactivate the field bus communication for machine control and other bus nodes.

CAUTION

Danger of personal injury and damage to property!
If danger-free operation of the valves via the Moog Valve and Pump Configuration Software can also not be ensured with deactivated field bus communication to the machine control and other bus nodes, the following must be heeded:

- The valves may only communicate with the Moog Valve and Pump Configuration Software in a depressurized state and via a direct connection (point-to-point).

CAUTION

Data loss!
Data exchange between the valve electronics and the Moog Valve and Pump Configuration Software may be disrupted if other fieldbus nodes (e.g., a controller) are accessing the valve electronics at the same time.

- Deactivate the field bus communication for machine control.

7.2 Block diagram

Block diagram of the valve electronics

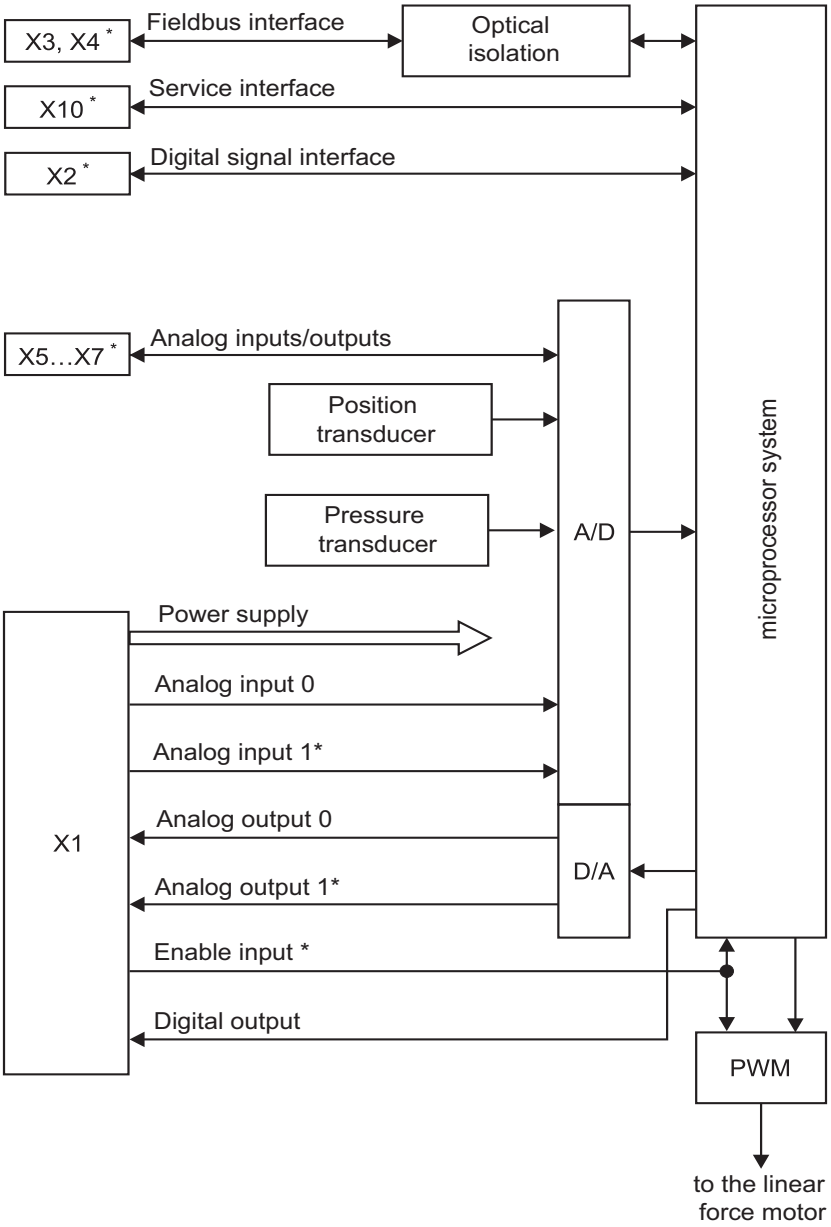


Fig. 22: Block diagram of the valve electronics

* Depending on the model, the valves can have different electrical connections.

7.3 Arrangement of connectors

The depiction of the electronics housing is exemplary for all sizes.

Arrangement of connectors on the valve electronics housing (maximum equipment specification)

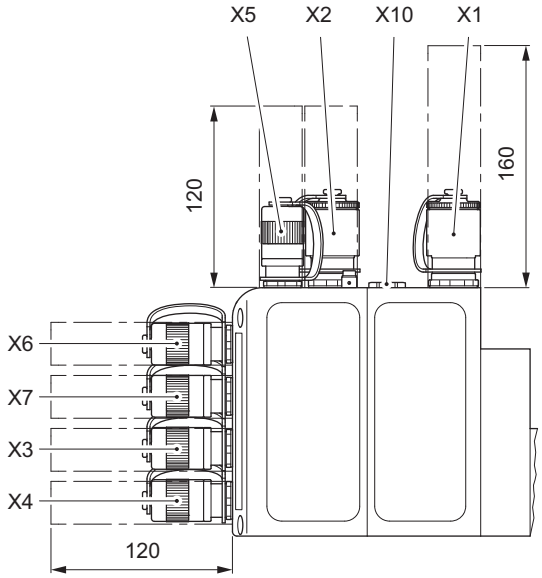


Fig. 23: Arrangement of connectors on the valve electronics housing (maximum equipment specification)

X1	Connectors, analog signals and supply voltage a Chap. "7.4 Connector X1", page 76
X2	Connector, optional digital signal interface a Chap. "7.7 Digital signal interface", page 82
X3 X4	The fieldbus connectors X3 and X4 are only provided on valves with fieldbus interfaces. a Chap. "7.8 Field bus connectors X3 and X4", page 84
X5 X6 X7	Connectors, analog signals a Chap. "7.9 Analog input connectors X5, X6 and X7", page 89
X10	The X10 service connector is only present for valves without CAN bus interface. By default, the X10 service connector is not approved for use in hazardous area, however on request it is available for use in hazardous area. a Chap. "7.10 Service connector X10", page 92

As standard, the electrical connection for the pilot valve is established by means of permanent cabling using explosion-proof cable entries.
If this cabling needs to be replaced during service work, there is the option of using cables with explosion-proof connectors. For this purpose, please select the letter R as character 5 in the type designation (see Chapter 13 "Ordering Information").
a Chap. "13 Ordering Information", page 237

Allocation of interfaces to connectors

Allocation of interfaces to connectors

The valve electronics are equipped with connectors that are designated X1 through X10.
The table below shows which interfaces are accommodated in the different connectors.

Interface type	Interface	Connector
Analog input	Analog input 0	X1
	Analog input 2	X5
	Analog input 3	X6
	Analog input 4	X7
Analog output	Analog output 0	X1
Digital input	Digital input 0	X1
Digital output	Digital output 0	X1
Digital signal interface	SSI transducer	X2
Field bus interface	CANopen, Profibus-DP, EtherCAT	X3, X4
Service interface		X10

Tab. 9: Allocation of interfaces to connectors

The availability of the interface depends on the model.

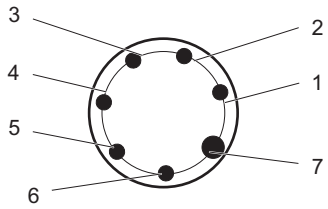
7.4 Connector X1

Service connector X1 is designed in accordance with EN 175201-804 and is available in the following versions:

- 7-pin connector with protective conductor contact

7.4.1 Pin assignment of connector X1

Assignment of service connector X1 (7-pin)



View of male receptacle X1 on the valve (internal thread, pin contacts)

Contact	Assignment	Description
1	Analog input 0	Current or voltage input referenced to pin 2, setpoint Q
2	Reference point for analog input 0 and input 1	Reference point for pins 1 and 3
3	Analog input 1	Current or voltage input referenced to pin 2, setpoint p
4	Analog output 0	4–20 mA or 2–10 V referenced to GND, actual value Q
5	Analog output 1	4–20 mA or 2–10 V referenced to GND, actual value p
6	supply voltage	Nominal 24 V (18–23 V) DC based on GND
7	GND, supply zero or signal zero	GND a Chap. "7.12 Protective grounding, equipotential bonding, and shielding", page 96

Fig. 24: Pin assignment connector X1 (7-pin) p/Q valves

a Chap. "7.14 Wiring connector X1", page 108

7.4.2 Mating connector for connector X1

Mating connector for connector X1

The mating connector for the 7-pin connector X1 is available as an accessory.
a Chap. "12.1 Accessories for valves in the D94xK type series", page 232
a Chap. "7.13 Permissible lengths for connection cables", page 104

7.4.3 Power supply

CAUTION

Risk of personal injury due to insufficient electrical safety
The insulating elements used are designed for the safety extra low voltage range. The circuits of the field bus connections, if provided, are only functionally isolated from other connected circuits.
Compliance with the safety regulations requires that the equipment be isolated from the mains system in accordance with EN 61558-1 and EN 61558-2-6 and that all voltages be limited in accordance with EN 60204--1.

- Nominal signal: see nameplate.
- Only use SELV/PELV power supplies

CAUTION

Risk of EMC damage!
Improper electrical connections can damage the valve electronics and destroy the field bus communication.

- Make the electrical connection so that it is EMC-appropriate.

Requirement of supply voltage

The supply voltage must be nominally 24 V (18–32 V) DC referenced to supply zero. Supply voltages of less than 18 V are detected by the valve electronics as undervoltage.

The valve electronics are protected against polarity reversal of the connections.

The power consumption of the valves varies from model to model.

7.5 Analog inputs/outputs

Analog inputs/outputs

The analog inputs/outputs are available on service connector X1 and analog inputs optionally on connectors X5, X6, and X7. The analog inputs can measure both current and voltage.

7.5.1 Analog inputs

All current and voltage inputs are differential, but can be connected to ground (single-ended) by means of external wiring. The analog inputs of connector X1 have a resolution of 12 bits.
a Chap. "7.14.1 Single-ended command signals", page 109

7.5.1.1 Signal types

Signal types of the analog inputs on service connector X1

The analog inputs on service connector X1 are available in the following versions:

- ±10 V
- 0–10 V
- ±10 mA
- 0–10 mA
- 4–20 mA

Which signal type is set for the analog inputs on delivery depends on the valve model. The signal types can be configured via the firmware.

Detailed information can be found in the "Firmware" User Manual.

Signal type for the analog input: ±10 V

Analog input: ±10

In the case of this signal type, the input is configured as a differential voltage input with a ±10 V input range.

The differential input resistance is 20 kΩ.

The input resistance referenced to supply zero is approx. 150 kΩ.
The potential difference of each input to supply zero must be between -15 V and 32 V.

If there is no differential analog source available, the reference point of the analog input (pin 5) must be connected to 0 V of the analog source.

Signal type for the analog input: 0–10 V

Analog input: 0 –10 V

In the case of this signal type, the input is configured as a differential voltage input with a 0–10 V input range.

The differential input resistance is 20 kΩ.

The input resistance referenced to supply zero is approx. 150 kΩ.

The potential difference of each input to supply zero must be between -15 V and 32 V.

If there is no differential analog source available, the reference point of the analog input (pin 5) must be connected to 0 V of the analog source.

Signal type for the analog input: ±10 mA

Analog input: ±10 mA

With this signal type, the input current to be measured is directed via the two input pins to an internal shunt.

The differential input resistance is 200 kΩ.

The input resistance referenced to supply zero is approx. 150 kΩ.

CAUTION

Risk of valve electronic damage!
The input current must be between -25 mA and 25 mA. Input currents outside this permissible range will destroy the input.
- Only use SELV/PELV power supplies.
- Heed the correct dimensioning of the cables.

The potential difference of each input to supply zero must be between -15 V and 32 V.

If there is no floating analog source available, the reference point of the analog input (pin 5) must be connected to 0 V of the analog source.

Signal type for the analog input: 0–10 mA

Analog input: 0–10 mA

With this signal type, the input current to be measured is directed via the two input pins to an internal shunt.

The differential input resistance is 200 kΩ.

The input resistance referenced to supply zero is approx. 150 kΩ.

CAUTION

Risk of valve electronic damage!
The input current must be between -25 mA and 25 mA. Input currents outside this permissible range will destroy the input.
- Only use SELV/PELV power supplies.
- Heed the correct dimensioning of the cables.

The potential difference of each input to supply zero must be between -15 V and 32 V.

If there is no floating analog source available, the reference point of the analog input (pin 5) must be connected to 0 V of the analog source.

Signal type for the analog input: 4–20 mA

Analog input: 4–20 mA

With this signal type, the input current to be measured is directed via the two input pins to an internal shunt.

The differential input resistance is 200 kΩ.

The input resistance referenced to supply zero is approx. 150 kΩ.

CAUTION

Risk of valve electronic damage!
The input current must be between -25 mA and 25 mA. Input currents outside this permissible range will destroy the input.
- Only use SELV/PELV power supplies.
- Heed the correct dimensioning of the cables.

The potential difference of each input to supply zero must be between -15 V and 32 V.

If there is no floating analog source available, the reference point of the analog input (pin 5) must be connected to 0 V of the analog source.

In the 4–20 mA signal range signals of I_{In} < 3 mA (e.g. due to a defective electric cable) signify a fault, which can be evaluated by the valve software. The monitoring must be activated in the valve software.

7.5.2 Analog outputs

Analog outputs 4–20 mA

Analog output: 4–20 mA

The reference point for the 4–20 mA analog outputs is supply zero.
The load impedance must be in the range of 0–500 Ω.

Cable break detection of the connected cable can be effected with the 4–20 mA analog outputs.

The 4–20 mA analog outputs are short-circuit protected.
a Chap. "7.14.2.1 Valves with 7-pin connector X1", page 110

Analog outputs 2–10 V

Analog output: 2–10 V

The reference point for the 2–10 V analog outputs is supply zero.
The internal resistance is 500 Ω.

Cable break detection of the connected cable can be effected with the 2–10 V analog outputs.

Voltage drops in the supply cable to the valve electronics can result in deviations from the actual value. Therefore, this variant is not recommended.
a Chap. "7.14.1 Single-ended command signals", page 109

Recommendation: Use a 4–20 mA analog output and terminate directly at the measurement input with 500 Ω. This way you get a 2-10V output without the disadvantages mentioned above.
a Chap. "7.14.2 Conversion of actual value output signals Iout", page 110

7.6 Digital inputs/outputs

Digital inputs/outputs

The digital inputs/outputs are available on service connector X1 depending on the model. The digital input serves as the enable input. Depending on the configuration, the digital output indicates specific events, such as for example the occurrence of a fault.

7.6.1 Digital input

Digital enable input

Enable input

Signals between 8.5 V and 32 V supply voltage referenced to supply zero at the enable input are identified as an enable signal.

Signals of less than 6.5 V at the enable input are identified as enable not issued. The electrical output stage is deactivated if no enable is issued or, depending on the versions, set to "HOLD".
This input is also used to acknowledge a valve fault state via an analog signal.

The input current of the digital enable input is 2.3 mA when connected to 24 V.

Detailed information can be found in the "Firmware pQ" user manual.

7.6.2 Digital outputs

Valve standby

The digital outputs are short-circuit protected and switch off in the event of overload. After a period of cooling down, the digital output switches itself back on. Overload means a current load greater than 1.5 A. However, the total current consumption of the valve must be limited by a fuse.

Logic level

High	Supply voltage connected.
Low	Supply voltage disconnected (10 kΩ to supply zero).

7.7 Digital signal interface

The digital signal interface is available on connector X2.
A digital transducer can be connected to this signal interface.

Connector X2 is available in the following versions:

- 7-pin SSI transducer connector X2
  a Chap. "7.7.1 SSI transducer", page 82

7.7.1 SSI transducer

This digital signal interface is suitable in accordance with EIA 422 for connecting e.g. position transducers or rotary transducers with an SSI interface.
a Chap. "7.15 Wiring SSI transducers (X2)", page 111

Supported types of SSI transducers

The following transducer types are supported:

- Coded with binary code
- Coded with Gray Code

The digital signal interface must be configured.

Detailed information can be found in the "Firmware" User Manual.

The signal levels conform to the standard EIA 422.

Recommended cable types

Recommended cable types for SSI transducer

Use exclusively shielded cables with copper braiding shielding with min. 80% overlap.
Copper conductors with a cross section of at least 0.25 mm^2.
Use cables with twisted-pair conductors in environments with high background noise levels.

Cable break monitoring

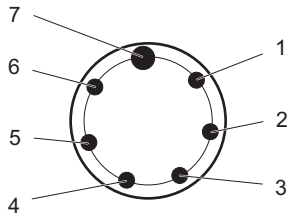
Cable break monitoring

Inputs CLK and DATA of the digital signal interfaces are monitored for cable break – regardless of which transducer type is connected.
The status of cable break monitoring can be read out via field bus. The reaction to a cable break is configurable.

Detailed information can be found in the "Firmware" User Manual.

7.7.1.1 Pin assignment SSI transducer connector X2

SSI transducer connector X2



View of SSI encoder
female receptacle X2 on valve
(external thread, socket contacts)

Contact	Assignment	Description
1	CLK+	Clock pulse output
2	CLK-	
3	DATA+	Data input for transducer data
4	DATA-	
5	SensorSup	Supply voltage to SSI transducer 24 V / 5 V / 0 V (configurable; see "Firmware" User Manual) I_{max} = 300 mA
6	GND	Supply zero
7		not used

Fig. 25: SSI transducer connector X2

Power supply to the transducer

Power supply to the transducer

Power is supplied to the transducer via pin 5 on connector X2.

There is joint fusing of this power supply for X2, X5, X6 and X7. The entire supply current may not exceed the following value: I_{max} (X2+X5+X6+X7) = 300 mA

The 24 V or 5 V supply voltage is configurable (see "Firmware" User Manual). An external power supply to the transducer is also possible. However, the 0 V transducer supply must be connected to supply zero.
The supply voltage is cut off in the event of a possible short circuit in the supply voltage to the transducer. A fault reaction can be configured (see "Firmware" User Manual). The voltage is available again as soon as the short circuit has been eliminated.

7.8 Field bus connectors X3 and X4

Versions of the field bus connector

Fieldbus connectors X3 and X4 are available in the following versions:

- 4-pin CAN connector
  a Chap. "7.8.1 CAN connectors", page 84
- 4-pin Profibus-DP connector
  a Chap. "7.8.2 Profibus-DP connectors", page 85
- 4-pin EtherCAT connector
  a Chap. "7.8.3 EtherCAT connectors", page 87

7.8.1 CAN connectors

The CAN bus has the following features:

- Multi-master system: Each node can transmit and receive
- Topology: Line structure with short stub lines
- Network expansion and transmission rates:
  25 m at 1 Mbit/s to 5,000 m at 25 kbit/s
- Addressing type: Message-orientated via identifiers
  Priority assignment of messages possible via identifiers
- Security: Hamming distance = 6, i.e. up to 5 individual errors per message are detected
- Physical bus: ISO 11898
- Max. nodes: 127 (via repeater)

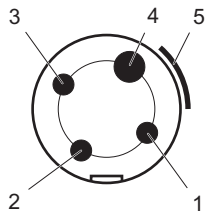
7.8.1.1 Technical data for the CAN bus interface

EMC protection requirements	Immunity to interference as per EN 61000-6-2 (evaluation criterion-A) Emitted interference as per EN 61000-6-4
Connectors X3 and X4	In each case a 4-pin plug connector with socket connectors (eXLink plug connector Fa. CEAG, coding 1h) a Chap. "7.8.1.2 Pin assignment, CAN connectors", page 85
Physical	ISO 11898 CAN-HIGH SPEED
Maximum voltage capacity	±40 V long-term (between CAN_H and CAN_L) ±500 V long-term referenced to supply zero (optical isolation) ±2.5 ESD (classification A: Human Body Model, C = 100 pF, R = 1.5 kΩ)
Maximum permissible number of CAN bus nodes	32 or 110 a Chap. "7.16.2 Permissible number of CAN bus nodes", page 116

Tab. 10: Technical data for the CAN bus interface

7.8.1.2 Pin assignment, CAN connectors

CAN connectors X3 and X4



View of CAN female receptacle X3 and X4 on valve
(external thread, socket contacts)

Contact	Assignment	Description
1	CAN_V+	Not connected in the valve
2	CAN_GND	CAN terminal resistor
3	CAN_H	Transceiver H
4	CAN_L	Transceiver L
5	CAN_SHLD	Shield (applied on the control cabinet side)

Fig. 26: CAN connectors X3 and X4

CAUTION

Danger of property damage due to improper plug connection!
In order to avoid damage to the explosion proof connector:
- Heed the notes and instructions in the "Ex connector eXLink" operating instructions.

7.8.2 Profibus-DP connectors

The Profibus-DP has the following features:

- Standardized in accordance with EN 61158-2 (type 3)
- Multi-master system:
  Masters share access time and initiate communication.
  Slaves react only on request.
- Topology: Line structure with short stub lines
- Network expansion and transmission rates:
  100 m at 12 Mbit/s to 1,200 m at 9.6 kbit/s per segment
  Use of repeaters possible
- Addressing type: address-oriented
  Priority/cycle time assignment of messages via master configuration
- Physical bus: RS 485 according to TIA/EIA-485-A
  Max. nodes: 127

7.8.2.1 Technical data for the Profibus-DP interface

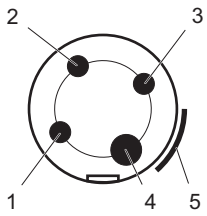
Technical data for the Profibus-DP interface

EMC protection requirements	Immunity to interference as per EN 61000-6-2 (evaluation criterion-A) Emitted interference as per EN 61000-6-4
Connectors X3 and X4	In each case a 4-pin plug connector with socket connectors (eXLink plug connector Fa. CEAG, coding 5h) a Chap. "7.8.2.2 Pin assignment, Profibus-DP connectors", page 86
Physical	Conformity as per test specification "PROFIBUS slaves Version 2.0 of the PNO, Order-No: 2.032"
Maximum voltage capacity	-9 V to 14 V (long-term) from signal cable to Profi GND ±500 V long-term referenced to supply zero (optical isolation) ±40 V with a pulse of 15 µs via a resistance of 100 Ω with an edge duration < 100 ns.
Maximum permissible number of Profibus-DP nodes	32 bus nodes without repeater With repeater up to 126 nodes

Tab. 11: Technical data for the Profibus-DP interface

7.8.2.2 Pin assignment, Profibus-DP connectors

Profibus DP connectors X3 and X4



View of Profibus-DP female receptacle X3 and X4 on valve
(external thread, socket contacts)

Contact	Assignment	Description
1	Profibus V+	Terminal resistors for RXD/TXD-P
2	Profibus A	RXD/TXD-N
3	Profibus A	Terminal resistors for RXD/TXD-N
4	Profibus B	RXD/TXD-P
5	Shield	Positioned on control cabinet side

Fig. 27: Profibus DP connectors X3 and X4

CAUTION

Danger of property damage due to improper plug connection!

In order to avoid damage to the explosion proof connector:

- Heed the notes and instructions in the "Ex connector eXLink" operating instructions.

7.8.3 EtherCAT connectors

The EtherCAT bus has the following features:

- Standardized in accordance with IEC 62407
- Single-master system:
  The master initiates communication.
  Slaves react only on request.
- Topology:
  Line, star, tree and ring structure based on the daisy chain principle
- Network expansion and transmission rates:
  100 m between two nodes at 100 Mbit/s
- Addressing type: Address-orientated, one telegram for all nodes
- Physical bus: Fast Ethernet
- Max. nodes: 65,535

7.8.3.1 Technical data for the EtherCAT interface

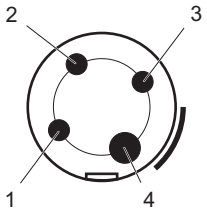
Technical data for the EtherCAT interface

EMC protection requirements	Immunity to interference as per EN 61000-6-2 (evaluation criterion-A) Emitted interference as per EN 61000-6-4
Connectors X3 and X4	In each case a 4-pin plug connector with socket connectors (eXLink plug connector Fa. CEAG, coding 5h) a Chap. "7.8.3.2 Pin assignment, EtherCAT connectors", page 88
Physical	4-core, paired cable as per CAT 5 for 100-Base-TX transmission Network topology: Tree and line Termination: device-internal Transmission rate: 100 Mbit/s As per EN 61158-2 Type 12 EtherCAT, "PHYSICAL LAYER SPECIFICATION AND SERVICE DEFINITION" and ISO/IEC 8802-3 100 Base-TX (IEEE 802.3 Section 24)
Maximum voltage capacity	±500 V long-term referenced to supply zero (optical isolation)
Maximum permissible number of EtherCAT bus nodes	65.536 The maximum number of nodes in a field bus line is 216.

Tab. 12: Technical data for the EtherCAT interface

7.8.3.2 Pin assignment, EtherCAT connectors

EtherCAT connectors X3 and X4



View of EtherCAT connectors X3 and X4 on valve
(external thread, socket contacts)

Contact	Assignment	Description
1	TX+	Transmit
2	RX+	Receive
3	TX-	Transmit
4	RX-	Receive

Fig. 28: EtherCAT connectors X3 and X4

CAUTION

Danger of property damage due to improper plug connection!
In order to avoid damage to the explosion proof connector:
- Heed the notes and instructions in the "Ex connector eXLink" operating instructions.

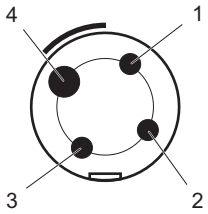
To connect the valves to an EtherCAT network, we recommend molded cord sets with an integral straight mating connector.
a Chap. "7.18 Wiring EtherCAT networks (X3, X4)", page 120

7.9 Analog input connectors X5, X6 and X7

The analog inputs of connectors X5, X6 and X7 have a resolution of 14 bits.

7.9.1 Pin assignment, analog input connectors X5, X6 and X7

Analog input connectors X5, X6 and X7



View of the analog input female receptacle X5, X6, and X7 on valve
(external thread, socket contacts)

Contact	Assignment	Description
1	Transducer supply	+24 V, I_{max} (X2+X5+X6+X7) = 300 mA referenced to pin 3
2	Reference point of analog input	Reference point for pin 4
3	Transducer supply 0 V	Supply zero
4	Analog input	Current or voltage input referenced to pin 2

Fig. 29: Analog input connectors X5, X6 and X7

a Chap. "7.19 Wiring analog inputs (X5, X6, X7)", page 123

Power supply to the transducer

Power supply to the transducer at connectors X5, X6, X7

The transducer is supplied with power via pin 1 of connectors X5, X6 and X7.
a Fig. 29, page 89

There is joint fusing of this power supply for X2, X5, X6 and X7. The entire supply current may not exceed the following value: I_{max} (X2+X5+X6+X7) = 300 mA

An external power supply to the transducer is also possible. However, the 0 V transducer supply must be connected to supply zero. An interruption of the transducer supply current can be identified as a cable break (see "Firmware" User Manual).
The supply voltage is cut off in the event of a possible short circuit in the supply voltage to the transducer. A fault reaction can be configured (see "Firmware" User Manual). The voltage is available again as soon as the short circuit has been eliminated.

7.9.2 Signal types

Signal types of the analog inputs at connectors X5, X6, X7

The analog inputs are available in the following versions:

- ±10 V
- 0–10 V
- 0–10 mA
- 4–20 mA

The inputs can be operated in each case differentially or single-ended (one input cable referenced to supply zero).

Which signal type is set for the analog inputs on delivery depends on the valve model. The signal types can be configured via the firmware.

Detailed information can be found in the "Firmware" User Manual.

Signal type for the analog input: ±10 V

Analog input: ±10

In the case of this signal type, the input is configured as either a differential or a single-ended voltage input with a ±10 V input range.
a Chap. "7.9.3 Input resistances", page 91

The potential difference of each input to supply zero must be between -15 V and 32 V.

If there is no differential analog source available, the reference point of the analog input (pin 2) must be connected to 0 V of the analog source.

Signal type for the analog input: 0–10 V

Analog input: 0 –10 V

For this signal type, the input is either configured as a differential or as a single-ended voltage input with 0–10 V input range.
a Chap. "7.9.3 Input resistances", page 91

The potential difference of each input to supply zero must be between -15 V and 32 V.

If there is no differential analog source available, the reference point of the analog input (pin 2) must be connected to 0 V of the analog source.

Signal type for the analog input: 0–10 mA

Analog input: 0–10 mA

In the case of this signal type, the input is configured as either a differential or a single-ended current input with a 0–10 mA input range.
a Chap. "7.9.3 Input resistances", page 91

The analog input is deactivated in the event of an excessively high input current.

The potential difference of each input to supply zero must be between -15 V and 32 V.

If there is no floating analog source available, the reference point of the analog input (pin 2) must be connected to 0 V of the analog source.

Signal type for the analog input: 4–20 mA

Analog input: 4–20 mA

In the case of this signal type, the input is configured as either a differential or a single-ended current input with a 4–20 mA input range.
a Chap. "7.9.3 Input resistances", page 91

The analog input is deactivated in the event of an excessively high input current.

The potential difference of each input to supply zero must be between -15 V and 32 V.

If there is no floating analog source available, the reference point of the analog input (pin 2) must be connected to 0 V of the analog source.

In the 4–20 mA signal range signals of I_{In} < 3 mA (e.g. due to a defective electric cable) signify a fault, which can be evaluated by the valve software. The monitoring must be activated in the valve software.

7.9.3 Input resistances

Input resistances

The input resistances of the analog inputs are dependent on the set signal type and the version.

Signal type	Version	R_D	R_1	R_2
Voltage ±10 V; 0–10 V	Differential	200 kΩ	250 kΩ	10 kΩ
	Single-ended	200 kΩ	250 kΩ	< 12 Ω
Current 0–10 mA; 4–20 mA	Differential	240 Ω	100 kΩ	10 kΩ
	Single-ended	252 Ω	100 kΩ	< 12 Ω

Tab. 13: Input resistances X5, X6, X7

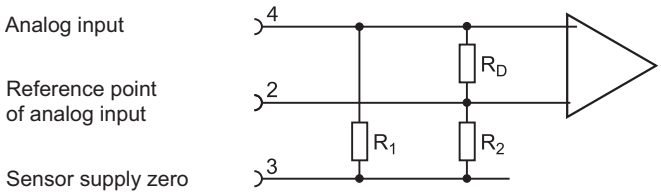


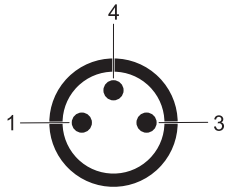
Fig. 30: Equivalent circuit diagram of analog input

7.10 Service connector X10

Service connector X10

This interface serves to connect diagnostic and start-up tools and is available on connector X10.

Service connector X10 (M8, 3-pin)



View of service connector X10; sunk in electronic housing
(external thread, pin contacts)

Contact	Assignment	Description
1	CAN_H	Transceiver H
3		Not assigned
4	CAN_L	Transceiver L

Fig. 31: Service connector X10 (M8, 3-pin)

Valves without CAN bus interfaces can be started up and configured via the service interface (service connector X10) with the Moog Valve and Pump Configuration Software.

WARNING

Danger of explosion!
To guarantee safe operation in hazardous area.

- In its standard model with screw plug, the service connector X10 is not permitted for use in a hazardous area.
- For mounting of the screw plug of the service connector X10, it must be observed that the gasket and the threads of the screw plug as well as the threads in the electronic housing of the valve are not damaged.
- If there is damage to the screw plug of the service connector or the thread in the electronic housing, the valve must not be operated in hazardous areas.
- Tightening torque screw plug:
  a Chap. "3.1.3 Representative depiction of the valve", page 19

DANGER

Danger of explosion!
An explosion can be triggered by sparks when switching on the machine.

- Open connectors for the interface must absolutely be covered before start-up.
- The eXLink connectors from CEAG must be mounted according to the instructions in the operating instructions for the eXLink connectors.
- In the standard model with a screw plug, the service connector X10 is not permitted for use in a hazardous area.
- The service connector X10 in the standard model M8, 3-pin must be sealed with the original screw plug belonging to the valve before start-up.
- When mounting the screw plug for the service connector X10, make sure that the seal and the thread of the screw plug as well as the thread in the electronic housing of the valve are not damaged.
- In case of damage to the screw plug for the service connector X10 or the threads in the electronic housing, the valve must not be operated.
- Tightening torque for screw plug:
  a Chap. "3.1.3 Representative depiction of the valve", page 19

For the standard model of the valve, the service interface is not suitable for use in hazardous areas. On request, the service interface is available in an explosion-proof model.

7.11 General notes on wiring

DANGER

Danger of explosion!
An explosion can be triggered by sparks when switching on the machine.

- Open connectors for the interface must absolutely be covered before start-up.
- The eXLink connectors from CEAG must be mounted according to the instructions in the operating instructions for the eXLink connectors.
- In the standard model with a screw plug, the service connector X10 is not permitted for use in a hazardous area.
- The service connector X10 in the standard model M8, 3-pin must be sealed with the original screw plug belonging to the valve before start-up.
- When mounting the screw plug for the service connector X10, make sure that the seal and the thread of the screw plug as well as the thread in the electronic housing of the valve are not damaged.
- In case of damage to the screw plug for the service connector X10 or the threads in the electronic housing, the valve must not be operated.
- Tightening torque for screw plug:
  a Chap. "3.1.3 Representative depiction of the valve", page 19

7.11.1 Tools and materials required

WARNING

Danger of explosion!
To guarantee safe operation in hazardous areas:

- The signal interfaces of the valve are implemented with explosion-proof connectors.
- For mounting and removal of the connectors as well as operation of the valve, the notes and instructions in the "Explosion-proof connectors eXLink, CEAG" operating instructions must absolutely be adhered to.

CAUTION

Danger of property damage due to improper plug connection!
In order to avoid damage to the explosion proof connector:

- Heed the notes and instructions in the "Ex connector eXLink" operating instructions.

Tool required

The following are required for electrically connecting the valves:

- Mating connector for connector X1 (7-pin)
- Connection cables for mating connector
- Crimping tool for mating connector with corresponding crimping insert
- Installation tool

The above-mentioned connectors, cables and tools are not included in the valve scope of delivery. They are supplied separately.
a Chap. "12.1 Accessories for valves in the D94xK type series", page 232

7.11.2 Procedure

Procedure for electrical connection

Procedure for electrically connecting the valve:

1. Conduct electrical connection in accordance with the pin assignment.
   a Chap. "7.4 Connector X1", page 76
2. Establish equipotential bonding, protective grounding and electrical shielding.
   a Chap. "7.12 Protective grounding, equipotential bonding, and shielding", page 96
   a Chap. "7.13 Permissible lengths for connection cables", page 104
3. Valves with field bus interface: wire field bus.
   a Chap. "7.16 Wiring CAN networks", page 112
   a Chap. "7.17 Wiring Profibus-DP networks (X3, X4)", page 117
4. Check whether all the connectors and if necessary the service connector to which no mating connector is attached are covered with a suitable dust protection cap.
5. If necessary, put a dust protection cap on.

Make sure to heed the instructions and notes in the eXLink plug connector operating instructions from CEAG.

7.11.3 Wiring of supply lines, evaluation of digital and analog signals

Evaluating the different signal types

Activation of the analog inputs with differential signals is to be preferred. If the signal cannot be transmitted differentially, the reference point of the input at the valve must be connected to ground (supply zero).
a Chap. "7.14.1 Single-ended command signals", page 109

Because current inputs have a lower input resistance than voltage inputs and are thus immune to interference, activation with a current signal is to be preferred to activation with a voltage signal.

Benefits of the different signal types for analog inputs

Signal type	Benefits
±10 V or 0–10 V	Simple measurement of the signal, e.g. with an oscilloscope.
±10 mA or 0–10 mA	Large transmission lengths are possible.
4–20 mA	Detection of faults in the electrical line and large transmission lengths are possible.

Tab. 14: Benefits of the different signal types for analog inputs

7.12 Protective grounding, equipotential bonding, and shielding

7.12.1 Overview

Guidelines for protective grounding

The valves with integrated electronics are equipped with a protective conductor connection (⏚) in the connector or on the valve body in accordance with the requirements of the standard EN 60204.
This chapter contains guidelines on protective grounding and electrical shielding of cables in applications in which the valves with integrated electronics are used.

CAUTION

Danger of personal injury and damage to property!
Improper protective grounding and shielding, as well as improper equipotential bonding, can cause damage, malfunctions or failures of the valve or the machine.

- The valves should only be used in such machines and plants that comply with the requirements of the standard EN 60204-1 and this chapter.

CAUTION

Risk of personal injury due to insufficient electrical safety
Compliance with the safety regulations requires that the equipment be isolated from the mains system in accordance with EN 61558-1 and EN 61558-2-6 and that all voltages be limited in accordance with EN 60204--1.

- Only use SELV/PELV power supplies!

7.12.2 Equipotential bonding and protective grounding

Equipotential bonding and protective grounding of machines

- The purpose of equipotential bonding is to establish as small a potential difference as possible within the machine.
- Protective grounding serves to maintain safety while the machine is in operation.
- The term protective earth or PE designates only a single point within the machine: the connection point of the external protective conductor. All additional connections to ground (⏚) are established via protective and equipotential bonding conductors.

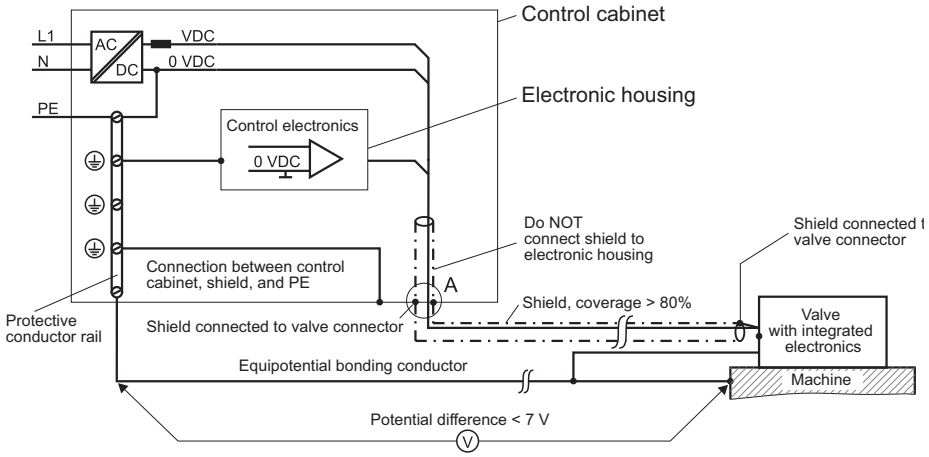


Fig. 32: Equipotential bonding and protective grounding of machines (see also EN 60204-1) and electrical shielding of our valves with integrated electronics

7.12.2.1 General principles

Performing equipotential bonding

DANGER

Danger of explosion in case of unsafe operation!
In order to create as small a potential difference in the machine as possible and guarantee safe operation of the machine, the equipotential bonding and protective conductor system for a machine in which the valves are to be used must be constructed according to EN 60204-1.

- Connect all elements of the machine to each other via equipotential bonding conductors.
- Connect all elements of the machine that have exposed metal surfaces to the protective conductor rail via protective conductors and equipotential bonding conductors.
- Connect all the protective conductors and the equipotential bonding conductor in the main cabinet via the protective conductor rail to the protective earth (PE) terminal.

Observe the following points when performing equipotential bonding and protective grounding:

- Connect all elements of the machine to each other via equipotential bonding conductors.
- Connect all elements of the machine that have exposed metal surfaces via protective conductors to the protective conductor rail.
- Connect all the protective conductors and the equipotential bonding conductor in the main cabinet via the protective conductor rail to the protective earth (PE) terminal.

Required cross section of the protective conductor

The cross section of the protective conductor is specified in EN 60204-1, Section 8. The following cross section have proven successful for equipotential bonding conductors:
up to 200 m cable length: 16 mm^2
up to 200 m cable length: 25 mm^2

Maximum potential difference

The potential difference between any two points within the machine should not be more than 7 V peak (7 $\hat{V}$).

- Connect the electrical shielding and the electrical ground of the electronics chassis point-to-point to the protective conductor rail.
- Before releasing a machine for normal operation, always check that all equipotential bonding and protective conductors are in proper working order in accordance with EN 60204-1, section 18.

7.12.2.2 Protective conductor

Requirements of the protective conductor

The valves must essentially only be operated with safe power supplies (SELV/PELV). No dangerous voltages are generated in the valve.
Therefore, no protective conductor must be connected.

DANGER

Danger to life!
People can be injured and property damaged through the operation of the valve with an unsafe power supply.

- Only use SELV/PELV power supplies in accordance with EN 60204.

7.12.2.3 Ground loops

Avoiding ground loops

If a valve is connected to protective earth (PE) both via the equipotential bonding system and via the valve protective conductor, a compensating current can split in the resulting ground loop. This current can cause serious malfunctions in the machine.
Observe the following points in order to minimize as much as possible malfunctions caused by a ground loop:

- Route the valve supply and signal cables as closely as possible to the equipotential bonding conductor.
  a Chap. "7.12.3 Machines with deficient equipotential bonding", page 100
- The impedance of the equipotential bonding system should be less than 10% of the impedance of the shielding of the lines.

7.12.3 Machines with deficient equipotential bonding

Deficient equipotential bonding

DANGER

Danger to life due to electric shock!
Very strong current can flow via the shield connection of the valve.

- Extreme caution is required since for some industrial applications, no good equipotential bonding can be implemented.
- An effective equipotential bonding system must be set up in compliance with EN 60204-1, Section 8.

7.12.4 Electrical shielding

Electrical shielding

An effectively shielded machine is, to a high degree, immune to external interference sources. Furthermore, the interference emitted by the machine is reduced considerably by effective shielding.

A functioning equipotential bonding system provides the basis for an effectively shielded machine. To ensure that the cables are effectively shielded, it is essential to satisfy the general requirements with regard to equipotential bonding and protective grounding.
a Chap. "7.12.2 Equipotential bonding and protective grounding", page 97

7.12.4.1 Cables

Requirements of cables

Observe the following points when choosing cables for connecting the valves:

- Only use shielded cables.
- The cable shield should be made of copper braiding with a minimum 80 % coverage.
- The individual conductors must be made of copper and have a minimum cross section of 0.2 mm^2 in accordance with EN 60204-1.
- Use cables with twisted pair conductors in environments with high background noise levels.
- The protective conductor should be guided within the cable shield.
  a Chap. "7.12.2.2 Protective conductor", page 98

7.12.4.2 Connecting the shield

When connecting the shielding, only connectors in the accessories for valves in the D67xK series may be used.

Connection on the valve side

Connecting the shield on the valve side

Connect the cable shield conductively to the metal shell of the connector.

Connection on control cabinet side

Connecting the shield on the control cabinet side

Connection on the control cabinet side can be completed with either lead-through cables or connectors.

Cable leadthrough

Connecting the shield with cable leadthrough

Observe the following points when connecting the shield on the control cabinet side:

- Connect the control cabinet's wall conductively to the protective conductor rail (⏚).
  a Fig. 32, page 97
- Connect the cable shield correctly (flat, conductively) to the control cabinet's wall.

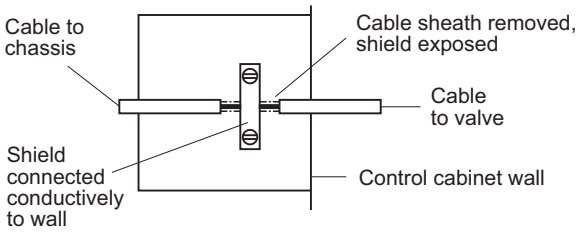


Fig. 33: Connecting the shield to the control cabinet's wall (detail A from Fig. 32)

WARNING

Danger due to electric shock!
The shield of the cable must be laid correctly in order to prevent faults in the machine and injuries to people.

- ▶ Do NOT connect the shield of the cable with the electronics chassis.

- Lead the cable shield without interruption through the wall of the EMC-compliant control cabinet as closely as possible to the electronics chassis, e.g. by means of a cable gland.

Plug connection

Connecting the shield with plug connection

Observe the following points when connecting the shield on the control cabinet side:

- Connect the control cabinet's wall conductively to the protective conductor rail (⏚).
  a Fig. 32, page 97
- Connect the shield of the cable coming from the valve to the housing of the removable connector.

The housing of the connector permanently mounted in the control cabinet must demonstrate a good-conducting connection with the wall of the control cabinet.

- Connect the connector mounted in the wall of the control cabinet to the shield inside the cabinet.

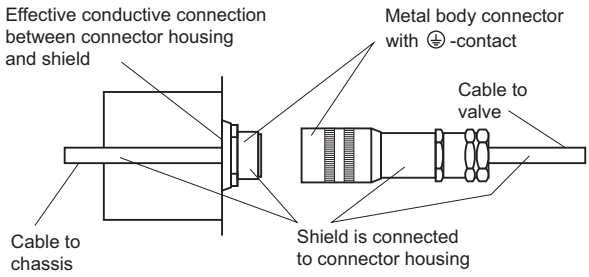


Fig. 34: Connecting the cable shield via connector to the control cabinet's wall (detail A from Fig. 32)

- Lead the shield inside the control cabinet as closely as possible to the electronics chassis.

WARNING

Danger due to electric shock!
The shield of the cable must be laid correctly in order to prevent faults in the machine and injuries to people.

- ▸ Do NOT connect the shield of the cable with the electronics chassis.

7.12.4.3 Insulated shielding

Insulated shielding in the event of deficient equipotential bonding

If connecting the shield to both ends of the cable is not desirable, such as in a machine with deficient equipotential bonding, insulated shielding may be required. However, this is normally only necessary if it is not possible to establish a good equipotential bonding system.

Observe the following points when connecting insulated shielding:

- Use metal shell connectors with a leading protective earth contact-(⏚) in accordance with EN 60204-1.
- Connect the cable shield conductively to the metal shell of the connector.
- Connect the control cabinet's wall conductively to the protective conductor rail (⏚).
  a Fig. 32, page 97
- Connect the cable shield via a capacitor (e.g. 10 nF / 100 VDC ceramic capacitor) to the control cabinet's wall.

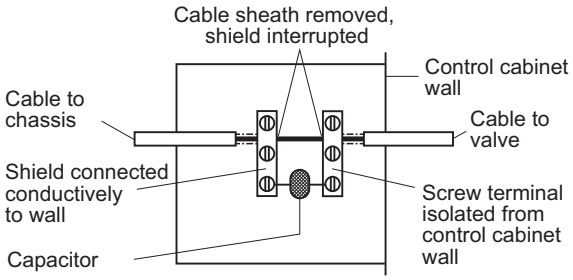


Fig. 35: Connecting the insulated shielding to the control cabinet's wall (detail A from Fig. 32)

- Install a separate shield connected to the control cabinet's wall inside the control cabinet. Route this shield as closely as possible to the electronics chassis.

WARNING

Danger due to electric shock!
The shield of the cable must be laid correctly in order to prevent faults in the machine and injuries to people.

- ▶ Do NOT connect the shield of the cable with the electronics chassis.

7.12.4.4 Cable routing

Cable routing inside the machine

The routing of the cable inside a machine must comply with the following general guidelines:

- Route supply and signal cables in separate cable conduits.
- In order to minimize malfunctions caused by a ground loop, route the valve connection cables as closely as possible to the equipotential bonding conductor.
  a Chap. "7.12.2.3 Ground loops", page 99
- Do not route cable conduits near strong electromagnetic interference sources, such as electric motors or transformers.
- If the cable routing cannot eliminate the risk of lightning strokes completely, suitable protective measures must be taken, as described in EN 60204-1.

7.13 Permissible lengths for connection cables

7.13.1 Introduction

Dimensioning of supply and signal cables

The valves with integrated electronics are supplied via 24 V supply cables and controlled via analog or field bus cables.

This section of the chapter is intended to serve as a guide to dimensioning and configuring supply and signal cables in order to guarantee adequate supply voltage and signal quality for all the permissible valve operating states.

The maximum permissible length of supply and signal cables is limited by the resistance and the capacitance per unit length of the cables.

7.13.2 Typical values for copper cables

The typical values specified here are used in the example calculations in the following sections.

7.13.2.1 Resistance of cable

Calculating the resistance

The typical resistance R_{typ} of a copper cable of length-l is calculated as follows:

$$R_{typ} = \frac{\rho_{Cu}}{q_{typ}} \cdot l \cdot = 23.73 \frac{m\Omega}{m} \cdot l$$

$q_{typ} = 0.25\ mm^2$ Typical cross section used for connection cables

$\rho_{Cu} = 0.0178 \frac{\Omega mm^2}{m}$ Resistivity of copper at 20 °C

7.13.2.2 Capacitance of cable

Calculating the capacitance

The typical capacitance per unit length of copper cables is 50 pF/m.
The typical capacitance C_{typ} of a copper cable of length-l is calculated as follows:

$$C_{typ} = 50 \frac{pF}{m} \cdot l$$

7.13.3 24V supply cables

Calculating the maximum length of supply cables

The maximum permissible length l_{max} of the supply cable is calculated as follows:

$$l_{max} = \frac{U_{dr\_max}}{\left(\frac{U_{ab}}{l}\right)_{typ}}$$

$$U_{dr\_max} = l_{max} \cdot \left(\frac{U_{ab}}{l}\right)_{typ}$$

U_{min} = 18 V	Lowest permissible supply voltage for valve
U_{dr_max} = 6 V	Maximum permissible voltage drop over the supply cable U_{dr_max} = 24 V - U_{min}
$\left(\frac{U_{ab}}{l}\right)_{typ}$	voltage drop per unit length a Chap. "7.13.3.1 Voltage drop per unit length", page 106

This calculation does not take into account a possible reduction of the power supply output voltage on account of the connected load. Nor does it take into account any voltage dips that can occur at the moment when additional loads are connected.

7.13.3.1 Voltage drop per unit length

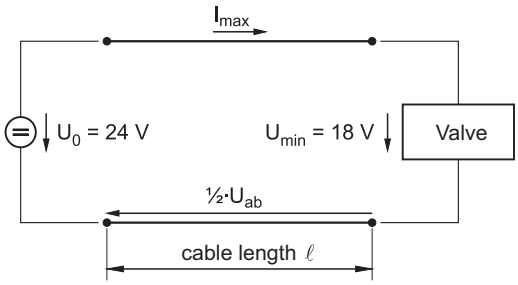


Fig. 36: Voltage drop on the supply cable

The voltage drop per unit length over the forward and return lines of the supply cable is calculated as follows:

$$\left(\frac{U_{ab}}{l}\right)_{typ} = 2 \cdot I_{max} \cdot \left(\frac{R_{typ}}{l}\right) = 2 \cdot I_{max} \cdot 23.73 \ \frac{m\Omega}{m}$$

I_{max} Maximum current consumption of valve (see product-specific valve user manual)

R_{typ} Typical resistance of the cable
a Chap. "7.13.2.1 Resistance of cable", page 104

l Length of the supply cable

7.13.3.2 Examples of the voltage drop of supply cables

Examples of the voltage drop of supply cables

Valve series	Max. current consumption I_{max}	Voltage drop $\left(\frac{U_{ab}}{l}\right)_{typ}$	Max. permissible cable length λ_{max}
D67xK + D94xK	350 mA	17 mV/m	364 m

Tab. 15: Examples of the voltage drop of supply cables as a function of the cable length for a cable cross section of 0.75 m^2

7.13.4 Analog signal cables

Influence of resistance R

Influence of resistance R

The influence of the resistance R of the cable used on the maximum cable length l_{max} for signal cables is very low, as the currents flowing through signal cables are very low.

Example:
For a cable length l of 428 m the resistance R according to the formula below is only 10 Ω.

$$R = \frac{\rho_{Cu}}{q_{typ}} \cdot l = 23.73 \frac{m\Omega}{m} \cdot 428\ m \approx 10\ \Omega$$

Influence of capacitance per unit length

Influence of capacitance per unit length

The influence of the capacitance per unit length of the cable used on the maximum cable length l_{max} for signal cables is considerably greater.

Calculating the limit frequency

The capacitance C that increases with the cable length forms with the input resistance R of an analog input a high pass of the first order, which can couple high-frequency interference for example at signal inputs. The limit frequency-f_l of the high pass is calculated as follows:

$$f_g = \frac{1}{2 \cdot \pi \cdot R \cdot C}$$

The longer the cable, the lower the limit frequency-f_l of the high pass.

Example:
A cable length l of 10 m and a typical analog input resistance R of 10 k Ω produce according to the formula below a limit frequency f_l of 32 kHz.

$$f_g = \frac{1}{2 \cdot \pi \cdot R \cdot C} = \frac{1}{2 \cdot \pi \cdot R \cdot 50 \frac{pF}{m} \cdot l}$$

$$f_g = \frac{1}{2 \cdot \pi \cdot 10\ k\Omega \cdot 50 \frac{pF}{m} \cdot 10\ m}$$

$$f_g = 32\ kHz$$

Recommendations

With a differential voltage command signal and a cable length-l of 10 m the EMC test was conducted in accordance with EN 61000-6-2. The interference on the spool position during the interference (electromagnetic coupling, transient) was below 1 %. This can worsen as the cable is lengthened.

Current input with cable length > 15 m

Experience shows that with cable lengths over 15 m a current input should be used, as here the input resistance is smaller by a factor of 50.
The limit frequency-f_l of the high pass also increases by the same factor, and with it the input becomes more immune to interference.

Furthermore, the voltage drop on the cable does not have an effect in the event of a current command signal.

Recommendation: differential input

A differential input is always to be recommended, regardless of whether a voltage or current signal is used as the command signal, since interference coupled on the two input cables is subtracted to virtually zero.

7.13.5 Digital signal cables

7.13.5.1 Digital signal input cables

Length of digital signal cables

Digital signal input cables, such as enable, are more non-critical with regard to their cable lengths, because the currents are low (< 20 mA) and a greater noise level distance is easier to maintain, since only two states/levels must be differentiated.

7.13.5.2 Digital signal output cables

With digital signal output cables, such as monitoring and standby, currents up to 1.5 A are encountered. In these cases, the voltage drop over longer cables can no longer be neglected. Thus, these cables are subject to the same requirements as supply cables.

a Chap. "7.13 Permissible lengths for connection cables", page 104

7.13.5.3 Field bus cables

Length of field bus cables

In the case of digital field bus cables, the maximum possible cable lengths are very different. For the most part the cable ends are terminated with low resistance (power adaptation) in order to avoid signal reflections, which permits longer cable lengths. The maximum possible cable lengths are laid down in the standards of the relevant field buses and depend among other things on the transmission rate used.

7.14 Wiring connector X1

Wiring of the 7-pin connector X1

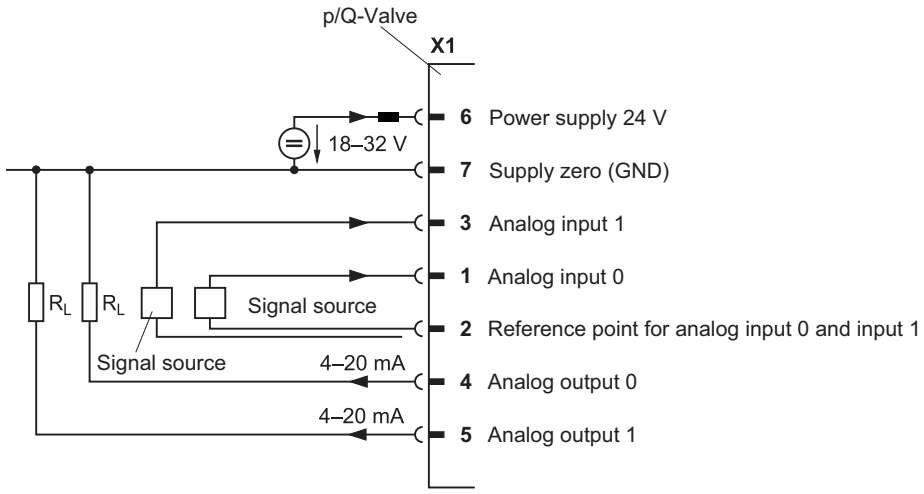


Fig. 37: Wiring of the 7-pin connector X1 pQ valve

7.14.1 Single-ended command signals

Basically, activation of the command inputs with differential signals is to be preferred. If the command signal cannot be transmitted differentially, the reference point of the command input at the valve must be connected to ground (GND).

Circuit for single-ended command signals

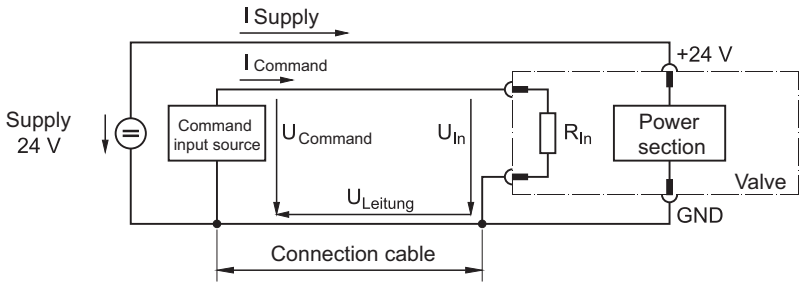


Fig. 38: Circuit for single-ended command signals

Single-ended connection of the command inputs

If the command inputs are connected to ground (single-ended), the connection cable must be as short as possible and have an appropriately large cross section in order to keep the voltage drop as low as possible.
The voltage drop on the forward and return lines is generated by the supply current I_{Supply} of the valve electronics power circuit. It is proportional to the length of the connection cable and varies according to the valve status.
Maximum permissible cable lengths:
a Chap. "7.13 Permissible lengths for connection cables", page 104

Input voltage $U_{in} = U_{comm} - U_{cable}$

The voltage drop U_{cable} on the return line and the resulting potential shift of ground (supply zero) results in not the command signal U_{comm} but rather the input voltage U_{in} being applied at the command input in accordance with the following equation:

$$U_{in} = U_{comm} - U_{cable}$$

Command signal sources with impressed current I_{comm}

In the case of command signal sources with impressed current I_{comm}, the potential shift of ground (supply zero) has no effect on the signal. However, changes in the voltage drop resulting from the valve's varying current consumption must be corrected by the command signal source. If current control does not follow the voltage change in terms of time, the command signal at the valve input may also be affected here.

The function of single-ended command inputs is identical to the function of differential command inputs.

7.14.2 Conversion of actual value output signals I_{out}

The actual value output signals I_{out} 4–20 mA can be converted into U_{out} 2–10 V in accordance with the following circuit.

Conversion of actual value output signals I_{out} 4–20 mA into 2–10 V

7.14.2.1 Valves with 7-pin connector X1

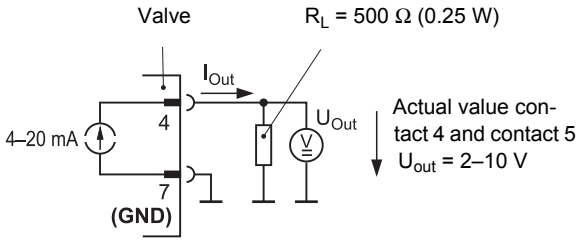


Fig. 39: Conversion of actual value output signals I_{out} (for valves with 7-pin connector X1)

7.15 Wiring SSI transducers (X2)

Wiring SSI transducers (X2)

An SSI transducer delivers an absolute position or angle signal, which can be read in via the digital signal interface.

7.15.1 SSI master mode

In SSI master mode the integrated electronics generate internally the SSI clock signal (CLK) with settable frequencies in the range between 78 kHz and 5 MHz.

Detailed information can be found in the "Firmware" User Manual.

In the rest state the clock signal is at 1. The first falling edge of the clock signal signals to the SSI transducer to maintain its current value. The following rising edge of the clock signal starts the data transmission of the SSI transducer. The output starts with the highest-value bit (MSB). After a complete data record has been transmitted, the SSI transducer holds the data signal at 0 until it is ready for a new transmission. The switching back of the data signal to 1 simultaneously satisfies the start condition for the SSI interface for triggering a new read-in cycle.

Wiring diagram with SSI transducer

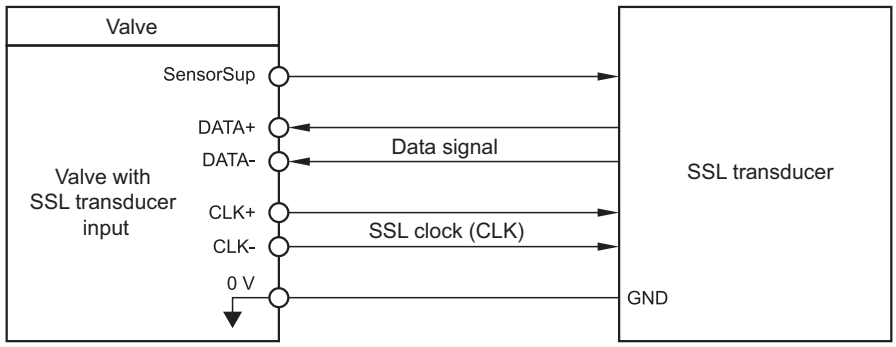


Fig. 40: Wiring diagram with SSI transducer

Signals between valve and a 16-bit SSI transducer (example)

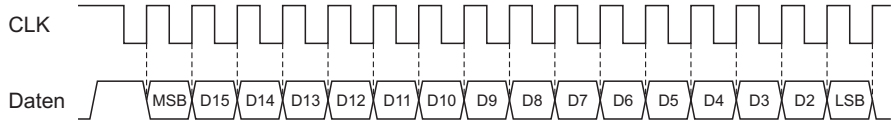


Fig. 41: Signals between valve and a 16-bit SSI transducer (example)

The signal levels conform to the standard EIA-422.

SSI transducers can be used with either Gray codes or binary coded data. A maximum of 32 bits is possible.

Detailed information can be found in the "Firmware" User Manual.

7.16 Wiring CAN networks

The valves are equipped with an electrically isolated CAN interface depending on the model. The CAN interface is supplied internally.

Procedure for connecting the valve to the CAN bus **Procedure**

CAUTION

Danger of personal injury and damage to property!
Failure to heed safety instructions causes malfunctions and thus corresponding risks to people and equipment.
- Please heed all the safety instructions prior to and during start-up.

1. Establish the electrical connection to the CAN bus.
a Chap. "7.8.1 CAN connectors", page 84
2. Set the module address.
a Chap. "7.16.3 CAN module address (node ID)", page 116
3. Set the transmission rate.
a Chap. "7.16.4 CAN transmission rate", page 116
4. Check the configuration of the valve software and the controller settings.

Observe the following points when wiring CAN networks:

- All cables, connectors and terminal resistors used in CAN networks should comply with ISO 11898.
- Correct version of protective grounding and electrical shielding.
a Chap. "7.12 Protective grounding, equipotential bonding, and shielding", page 96
- Use shielded cables with four cores (twisted pair) and surge impedance of 120 Ω (CAN_H, CAN_L, CAN_GND and CAN_SHLD grounded).
- A CAN bus cable must not branch but short stub cables with T-connectors are permitted.
- Stub cables must be as short as possible.
- Maximum stub cable length:
a Chap. "7.16.1 Cable lengths and cable cross sections", page 115
- The cable between CAN_L and CAN_H at both CAN bus cable ends must be ended by a terminal resistor of 120 Ω ± 10 %.
- Reference potential CAN_GND and CAN_SHLD may be connected to protective earth/ground (PE) at one point only (on a connector with terminal resistor, for example).
- A terminal resistor can be omitted if the valve-internal terminal resistor (deactivated as standard) is activated (for configuration, see "Firmware" User Manual).
- The transmission rate must be adapted to the CAN bus cable length.
a Chap. "7.16.1 Cable lengths and cable cross sections", page 115

- The maximum permissible number of CAN bus nodes in the CAN network must not be exceeded.
  a Chap. "7.16.2 Permissible number of CAN bus nodes", page 116
- Do not lay CAN Bus cables in the immediate vicinity of disturbance sources. If interference sources cannot be avoided, use double-shielded cables.

Wiring diagram of the CAN network

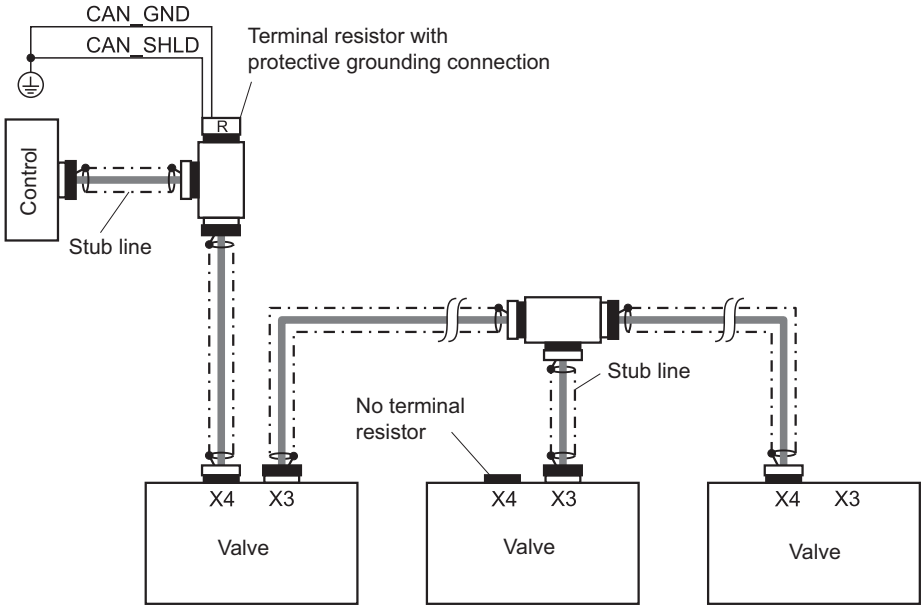


Fig. 42: CAN wiring diagram

Customer-side connection of CAN bus to the valve if terminal resistor is required

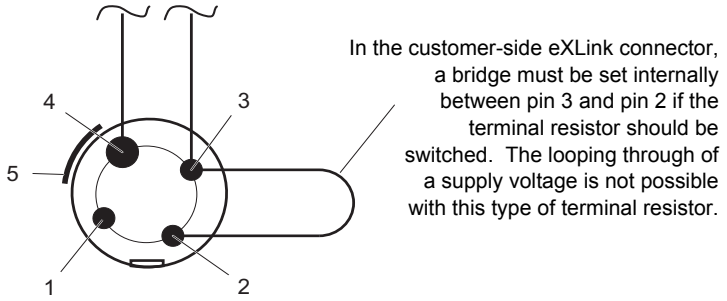


Fig. 43: Connection of the CAN bus valve with terminal resistor

Interference immunity in CAN networks

For CAN bus nodes without a galvanically isolated CAN bus interface, CAN_GND is generally connected to supply voltage GND inside the device.
In these cases, the power supply connection cable must be grounded at the same point inside the machine as the CAN_GND connection cable.
Maximum interference immunity is achieved in extensive CAN networks by using solely CAN bus nodes with galvanically isolated CAN bus interface.
If it is not possible to dispense with CAN bus nodes without galvanically isolated CAN bus interface, arrange these nodes in the immediate vicinity of the central ground point. The cable length to this central ground point is to be kept as short as possible. It is particularly important in this respect to ensure that the equipotential bonding line is properly dimensioned!

Connection of the valve to a PC via the CAN bus interface (X3)

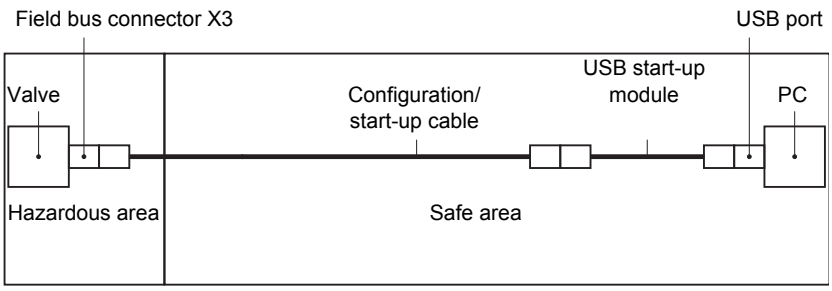


Fig. 44: Connection of the valve to a PC via the CAN bus interface (field bus connector X3)

DANGER

Danger of explosion!

To guarantee safe operation in a hazardous area:

- In its standard model with screw plug, the service connector X10 is not permitted for use in a hazardous area.
- For mounting of the screw plug of the service connector X10, it must be observed that the gasket and the threads of the screw plug as well as the threads in the electronic housing of the valve are not damaged.
- If there is damage to the screw plug of the service connector or the thread in the electronic housing, the valve must not be operated in hazardous areas.
- Tightening torque screw plug:
  a Chap. "3.1.3 Representative depiction of the valve", page 19

The use of the service interface in the standard version is only permitted outside the hazardous areas.

7.16.1 Cable lengths and cable cross sections

Cable lengths and cable cross sections

Transmission rate	Maximum cable length
1000 kbit/s	25 m
800 kbit/s	50 m
500 kbit/s	100 m
250 kbit/s	250 m
125 kbit/s	500 m
100 kbit/s	650 m
50 kbit/s	1000 m
20 kbit/s	2500 m

Tab. 16: Recommendation for maximum cable lengths in CAN networks, depending on the transmission rate

Maximum cable length

Cable cross section	Maximum cable length for n CAN bus nodes		
	n = 32	n = 64	n = 100
0.25 mm^2	200 m	170 m	150 m
0.50 mm^2	360 m	310 m	270 m
0.75 mm^2	550 m	470 m	410 m

Tab. 17: Recommendation for maximum cable lengths in CAN networks, depending on the cable cross section and the number n of CAN bus nodes

Maximum length of stub cables

Transmission rate	Maximum stub cable length	
	Maximum	Cumulative
1000 kbit/s	2 m	20 m
500 kbit/s	6 m	39 m
250 kbit/s	6 m	78 m
125 kbit/s	6 m	156 m

Tab. 18: Maximum permissible stub cable lengths in CAN networks

7.16.1.1 Suitable cable types for CAN networks

Suitable cable types for CAN networks

Parameter	Value
Surge impedance	120 Ω

Tab. 19: Specification of electrical data for CAN bus cables

Manufacturer	Cable type
Web: http://www.draka-mog.com	Draka ToughCAT7 Mud Protected

Tab. 20: Suitable cable types for CAN networks

7.16.2 Permissible number of CAN bus nodes

Maximum number of CAN bus nodes

The CAN bus interface for the valve electronics supports integration in CAN networks with up to 110 CAN bus nodes.

However, the maximum permissible number of CAN bus nodes can be restricted by other nodes with an older CAN bus driver to 32.

A maximum of 127 nodes can be operated in a CAN network thanks to the use of repeaters. However, it is necessary to bear in mind here the additionally inserted signal propagation time, which limits the maximum expansion of the CAN network.

7.16.3 CAN module address (node ID)

CAN module address (node ID)

CAUTION

Danger due to malfunctions!
A multiple use of module addresses causes malfunctions and thus corresponding dangers to people and equipment.

- Each module address may only be used once within a CAN bus network.

The factory setting for the module address of the valve electronics is 127.

The module address can be changed with the LSS services (Layer Setting Services) via the CAN bus.
If there are no additional nodes present on the CAN bus, it is possible to set the node ID via the LSS Service Switch Mode Global.

To change the module address of the valve electronics with a CAN bus network, it is essential to address the valve electronics unambiguously via the LSS address. The node ID is then set via the LSS Service Switch Mode Selective.

It is also possible to configure the module address via service interface X10.

The module address of the valve electronics can also be altered with the Moog Valve and Pump Configuration Software.

7.16.4 CAN transmission rate

CAN transmission rate

The transmission rate must be set to the same value for all the CAN bus nodes within a CAN bus network.

The factory setting for the transmission rate is 500 kbit/s.

The transmission rate can be changed with the LSS services (Layer Setting Services) via the CAN bus.

The transmission rate of the valves/pumps can also be altered with the Moog Valve and Pump Configuration Software.

7.17 Wiring Profibus-DP networks (X3, X4)

Wiring, Depending on the Model, of Profibus-DP Networks

The valves are equipped with an electrically isolated Profibus-DP interface depending on the model. The Profibus-DP interface is supplied internally.

Procedure

Procedure for connecting the valves to the Profibus-DP

CAUTION

Danger of personal injury and damage to property!
Failure to heed safety instructions causes malfunctions and thus corresponding risks to people and equipment.
- Please heed all the safety instructions prior to and during start-up.

1. Establish the electrical connection to the Profibus-DP.
a Chap. "7.8.2 Profibus-DP connectors", page 85
2. Set the module address.
a Chap. "7.17.3 Profibus-DP module address (node ID)", page 119
3. Check the configuration of the valve software and the controller settings.

Observe the following points when wiring Profibus-DP networks:

- It is recommended to use 2-core Profibus cables so as to prevent the power supply to the terminal resistors from being connected in parallel.
- The specification EN 61158-2 describes two cable types. Type B can be used with limitation.
- Stub cables must be as short as possible.
- Avoid stub cables in the case of transmission rates in excess of 1,500 kbit/s.
- If stub cables are used, do not use any terminal resistors in this branch.
- The stub cable length in the case of transmission rates in excess of 1,500 kbit/s should not exceed 6.6 m in total.

Wiring diagram of the Profibus-DP networks

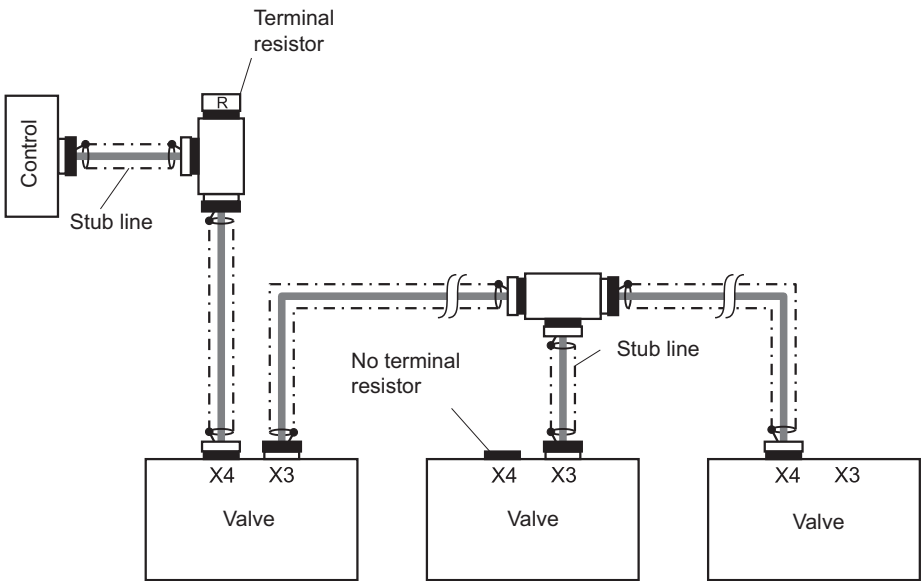


Fig. 45: Profibus-DP wiring diagram

Customer-side connection of Profibus to the valve if terminal resistor is required

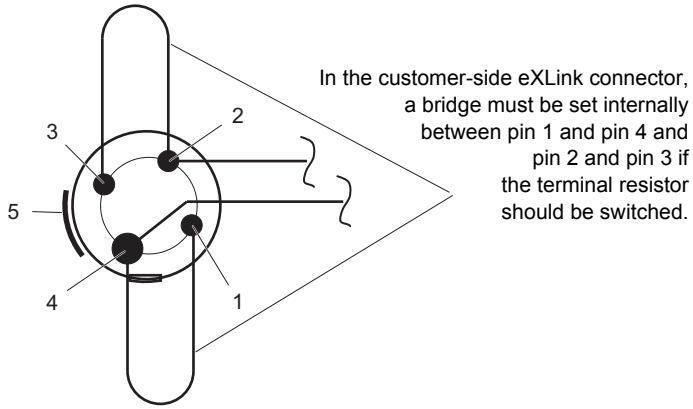


Fig. 46: Connection valve Profibus with terminal resistor

7.17.1 Cable lengths and cable cross sections

Cable lengths and cable cross sections

Transmission rate	Maximum cable length without repeaters
12,000 kbit/s	100 m
1,500 kbit/s	200 m
500 kbit/s	400 m
187.5 kbit/s	1,000 m
93.75 kbit/s	1,200 m
45.45 kbit/s	1,200 m
19.2 kbit/s	1,200 m
9.6 kbit/s	1,200 m

Tab. 21: Recommendation for maximum cable lengths in Profibus-DP networks, depending on the transmission rate

7.17.1.1 Suitable cable types for Profibus-DP networks

Suitable cable types for Profibus-DP networks

Parameter	Value
Characteristic cable impedance (Ω)	135 to 165 at 3 to 20 MHz
Effective capacitance (pF/m)	< 30
Loop impedance (Ω/km)	< 110
Cable diameter (mm)	> 0.64
Cable cross section (mm^2)	> 0.34

Tab. 22: Specification of electrical data for Profibus-DP cables (as per type A)

Manufacturer	Cable type
Web: http://www.drakamog.com	Draka ToughCAT7 Mud Protected

Tab. 23: Suitable cable types for Profibus-DP networks

7.17.2 Permissible number of Profibus nodes

Permissible number of Profibus-DP nodes

The Profibus-DP interface of the valve electronics supports integration into Profibus-DP networks with up to 32 Profibus nodes.

A maximum of 126 nodes can be operated in a Profibus-DP network with the use of repeaters.

7.17.3 Profibus-DP module address (node ID)

Profibus-DP module address (node ID)

CAUTION

Danger due to malfunctions!
A multiple use of module addresses causes malfunctions and thus corresponding dangers to people and equipment.
- Each module address may only be used once within a Profibus DP network.

The module address can be configured by sending a Set_Slave_Add telegram from a controller. There is also the option of configuring the module address by writing to the Profibus module identifier.

It is also possible to configure the module address via service interface X10.

The factory setting for the module address of the valve electronics is 126.

The module address of the valve electronics can also be altered with the Moog Valve and Pump Configuration Software.

7.17.4 Profibus-DP transmission rate

Profibus-DP transmission rate

The valve electronics are automatically set to the transmission rate specified by the Profibus master. It is not possible, nor is it necessary, to configure the transmission rate on the slave side.

7.18 Wiring EtherCAT networks (X3, X4)

Wiring EtherCAT networks

The valves are equipped with an electrically isolated EtherCAT interface depending on the model. The EtherCAT interface is supplied internally.

Procedure

Procedure for connecting the valves to the EtherCAT bus

CAUTION

Danger of personal injury and damage to property!
Failure to heed safety instructions causes malfunctions and thus corresponding risks to people and equipment.
- Please heed all the safety instructions prior to and during start-up.

1. Establish the electrical connection to the EtherCAT bus.
a Chap. "7.8.3 EtherCAT connectors", page 87
2. Optional: Set the module address.
a Chap. "7.18.3 EtherCAT module address (node ID)", page 122
3. Check the configuration of the valve software and the controller settings, in particular the command signal source.

Detailed information can be found in the "Firmware" User Manual.

Observe the following points when wiring EtherCAT networks:

- All cables must be designed as shielded cables with twisted-pair litz wires as per ISO/IEC 8802-3 100 Base-TX and CAT 5 as per ANSI/TIA/EIA-568-B.1.
- The cable length between two nodes must not exceed 100 m as per ISO/IEC 8802-3 100 Base-TX.
- The maximum permissible number of EtherCAT nodes must not exceed 65,536.
- The cable between the nodes must not branch.
- An external cable termination (terminal resistor) as in CAN or Profibus-DP networks is not necessary.

Wiring diagram of the EtherCAT network

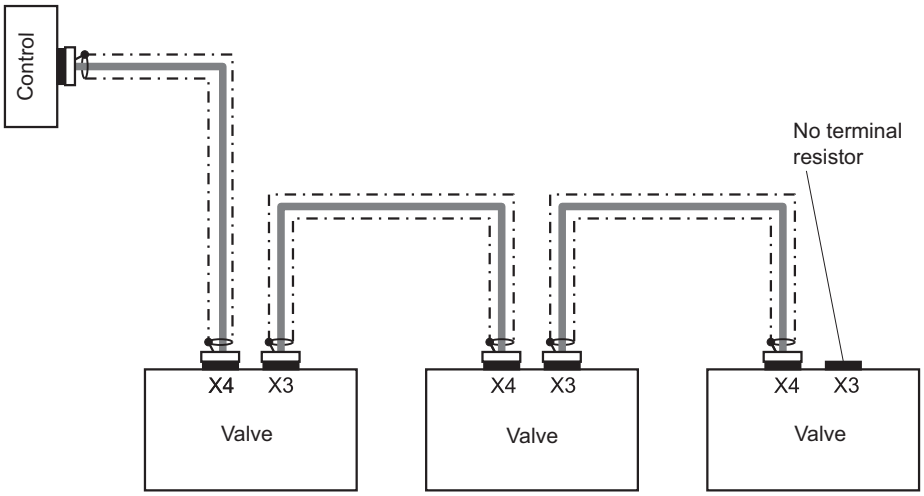


Fig. 47: EtherCAT wiring diagram

Pin assignment for the EtherCAT cable

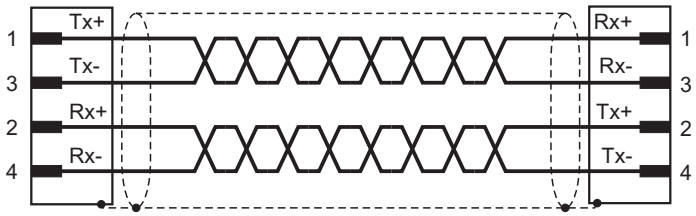


Fig. 48: Twisted-pair litz wires in Ethernet/EtherCAT cables with M12 connectors

An RJ45 connector is usually used on the controller side. The colors of the litz wires are standardized in accordance with IEEE 802.3 for Ethernet.

Signal	X3, X4	Litz wire	RJ45	Litz wire (RJ45, 4-core cable)
TX+	1	orange	1	orange/white (yellow/white)
RX+	2	blue	3	green/white
TX-	3	white (shielded with orange)	2	orange
RX-	4	white (shielded with blue)	6	green
Shield	Housing			

Tab. 24: Assignment of Ethernet/EtherCAT signals with mixed connector types

7.18.1 Suitable cable types for EtherCAT networks

Suitable cable types for EtherCAT networks

CAT 5 cable according to ANSI/TIA/EIA-568-B.1. e.g. Draka ToghCAT7 Mud Protected

7.18.2 Permissible number of EtherCAT nodes

Permissible number of EtherCAT nodes

The EtherCAT interface of the valve electronics supports integration into EtherCAT networks with up to 65,535 EtherCAT nodes.
The maximum number of nodes in a field bus line is 216.

The number of nodes determines the signal propagation time of the data packets and the resulting possible cycle times.

7.18.3 EtherCAT module address (node ID)

EtherCAT module address (node ID)

CAUTION

Danger due to malfunctions!
A multiple use of module addresses causes malfunctions and thus corresponding dangers to people and equipment.
- Each module address may only be used once within an EtherCAT network.

EtherCAT nodes can be addressed using the physical position within the network. This procedure is known as auto-increment addressing.

If position-independent addressing is preferred, a static module address can also be allocated. This addressing type is known as fixed node addressing.

Auto-increment addressing

Each EtherCAT node is identified using the physical position within the network segment. For this purpose, each EtherCAT node increments a 16-bit address field within a telegram, which is sent through the entire network. The advantage of this mechanism lies in the fact that no module address has to be set manually for the field bus nodes.

Fixed node addressing

With fixed node addressing a node is addressed via the so-called Configured Station Alias. This address can be configured by the network master in the Slave Information Interface (SII).

There is also the option of configuring the module address by writing to the EtherCAT module identifier.

The advantage of fixed node addressing over auto-increment addressing lies in the fact that the nodes can still be addressed at the same address even after the network topology has been changed or after nodes have been added or removed.

The factory setting for the module address of the valve electronics is 0.

It is also possible to configure the module address via service interface X10.

The module address of the valve electronics can also be altered with the Moog Valve and Pump Configuration Software.

7.18.4 EtherCAT transmission rate

EtherCAT-DP transmission rate

EtherCAT works with a fixed transmission rate of 100 Mbit/s.

7.19 Wiring analog inputs (X5, X6, X7)

Maximum current of transducer supply

The signal connectors X5, X6, and X7 are wired the same in the valve. On pin 1, a supply voltage of 24 V DC is made available by the valve in order to supply sensors.

There is joint fusing of this power supply for X2, X5, X6 and X7. The entire supply current may not exceed the following value: I_{max} (X2+X5+X6+X7) = 300 mA

An external power supply to the transducer is also possible. However, the 0 V transducer supply must be connected to supply zero. An interruption of the transducer supply current can be identified as a cable break (see "Firmware" User Manual).
The supply voltage is cut off in the event of a possible short circuit in the supply voltage to the transducer. A fault reaction can be configured (see "Firmware" User Manual). The voltage is available again as soon as the short circuit has been eliminated.

The supply current for each transducer is monitored for the purpose of detecting cable breaks. Supply currents under 1 mA can trigger a configurable fault reaction.

2/3/4-wire transducers with a voltage or current output can be connected to X5, X6 and X7. Each input can be individually adapted.

2-wire transducers

2-wire transducers can only be operated in the signal type for the 0–10 mA or 4–20 mA analog input in the single-ended version.

Wiring the 2-wire transducer

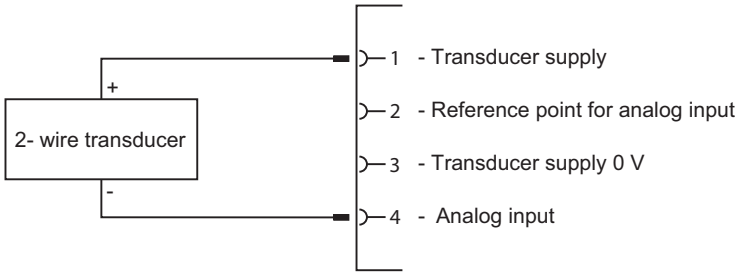


Fig. 49: Connecting a 2-wire transducer to analog input connectors X5, X6 or X7

3-wire transducers

3-wire transducers can only be operated in the single-ended version.

Wiring the 3-wire transducer

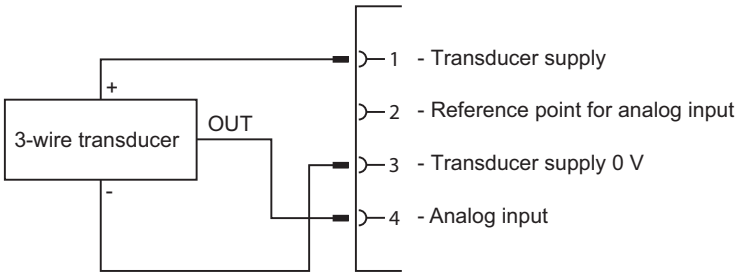


Fig. 50: Connecting a 3-wire transducer to analog input connectors X5, X6 or X7

4-wire transducers

4-wire transducers should be operated in the differential version.

Wiring the 4-wire transducer

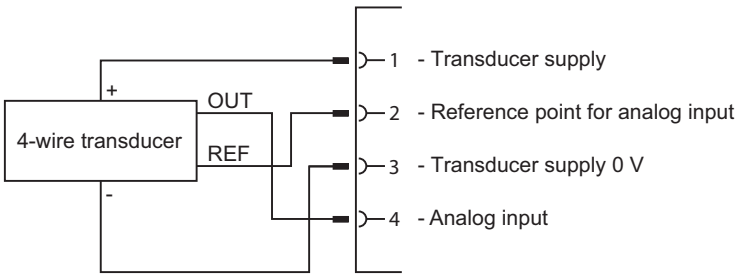


Fig. 51: Connecting a 4-wire transducer to analog input connectors X5, X6 or X7

7.20 Electrical start-up

DANGER

Danger of explosion!
An explosion can be triggered by sparks when switching on the machine.

- Open connectors for the interface must absolutely be covered before start-up.
- The eXLink connectors from CEAG must be mounted according to the instructions in the operating instructions for the eXLink connectors.
- In the standard model with a screw plug, the service connector X10 is not permitted for use in a hazardous area.
- The service connector X10 in the standard model M8, 3-pin must be sealed with the original screw plug belonging to the valve before start-up.
- When mounting the screw plug for the service connector X10, make sure that the seal and the thread of the screw plug as well as the thread in the electronic housing of the valve are not damaged.
- In case of damage to the screw plug for the service connector X10 or the threads in the electronic housing, the valve must not be operated.
- Tightening torque for screw plug:
  a Chap. "3.1.3 Representative depiction of the valve", page 19

WARNING

Danger of explosion!
To guarantee safe operation in hazardous areas:

- The signal interfaces of the valve are implemented with explosion-proof connectors.
- For mounting and removal of the connectors as well as operation of the valve, the notes and instructions in the "Explosion-proof connectors eXLink, CEAG" operating instructions must absolutely be adhered to.

WARNING

Danger of explosion!
For electrical start-up, cables on the valve, cable glands, screw plugs, and connectors must not be damaged.

- The valve must not be started up with damaged cables, connectors or screw plugs, and it must be sent to us or to one of our authorized service centers immediately.

For the standard model of the valve, the service interface is not suitable for use in hazardous areas. On request, the service interface is available in an explosion-proof model.

7.21 Electromagnetic compatibility (EMC)

EMC requirements

The machine manufacturer is responsible for complying with the EMC Directive.

The valves fulfill the EMC protective requirements for immunity to interference as per EN 61000-6-2:(assessment criterion A) and for interference emissions according to EN 61000-6-4

The following technical requirements must be in place so that the EMC protection requirements can be satisfied:

- Use of the mating connectors recommended for the valves.
  a Chap. "12.1 Accessories for valves in the D94xK type series", page 232
- Adequate shielding.
- Correct execution of equipotential bonding system, protective grounding and electrical shielding.
  a Chap. "7.12 Protective grounding, equipotential bonding, and shielding", page 96

7.22 Communication via the Moog Valve and Pump Configuration Software

CAUTION

Danger of personal injury and damage to property!
Improper handling of the Moog Valve and Pump Configuration Software causes malfunctions and thus corresponding risks to people and equipment.

- For safety reasons, the Moog Valve and Pump Configuration Software must not be used inside a machine for visualization purposes or as an operator terminal.

CAUTION

Danger of personal injury and damage to property!
It is not permitted to operate the Moog Valve and Pump Configuration Software on a fieldbus while the machine is running.
It is only permitted to activate valves via the Moog Valve and Pump Configuration Software if this does not cause any dangerous states in the machine and in its surroundings.

CAUTION

Danger of personal injury and damage to property!
Activating valves via the Moog Valve and Pump Configuration Software within a network can give rise to unforeseeable events if field bus communication takes place simultaneously between the machine control or other bus nodes!

- Deactivate the field bus communication for machine control and other bus nodes.

CAUTION

Danger of personal injury and damage to property!
Messages from the Moog Valve and Pump Configuration Software can also be received by other bus nodes. This may trigger unforeseeable events.

- Deactivate the field bus communication for machine control and other bus nodes.

CAUTION

Danger of personal injury and damage to property!
If danger-free operation of the valves via the Moog Valve and Pump Configuration Software can also not be ensured with deactivated field bus communication to the machine control and other bus nodes, the following must be heeded:

- The valves may only communicate with the Moog Valve and Pump Configuration Software in a depressurized state and via a direct connection (point-to-point).

CAUTION

Data loss!
Data exchange between the valve electronics and the Moog Valve and Pump Configuration Software may be disrupted if other fieldbus nodes (e.g., a controller) are accessing the valve electronics at the same time.
- ▸ Deactivate the field bus communication for machine control.

Operating the Moog Valve and Pump Configuration Software

The Moog Valve and Pump Configuration Software communicates with the valves via the CAN interface. The CAN bus interface is either on the service interface X10 or available on the CAN fieldbus interface -X3 and X4.

Possible faults

If the Moog Valve and Pump Configuration Software is operated within a CAN network with machine fieldbus communication running, the following faults may occur:

- Data exchange with the valve may be disrupted if another device (such as a controller) accesses the valve simultaneously.
- Node guarding may be activated only if no other field bus node is monitoring the valves via this service.
- Field bus telegrams can also be received by other field bus nodes. This may trigger off unforeseeable events!

To establish a direct connection between Moog Valve and Pump Configuration Software and valve, detach the field bus cable from the valve and connect the valve directly to the USB CAN interface of the service PC. A 120 Ω ± 10 % terminal resistor is required here.

The configuration/start-up cable not included in the scope of delivery already features a terminal resistor.
This configuration/start-up cable can only be used outside of hazardous areas. The cable can only be used in connection with the M8-M12 adapter and thus only on the service connector X10.
a Chap. "12.1 Accessories for valves in the D94xK type series", page 232

8 Start-up

Safety instructions: Start-up

DANGER

Danger to life!
Operating machines with damaged or defective components or with a leaking hydraulic system is dangerous and not permitted.

- Before starting up or operating the valves, check the higher-level machine including all its installed components for damage and defects.
- Pay particular attention here to higher-level and hydraulic safety devices such as, for example, EMERGENCY STOP switches and pressure-limiting valves.
- Report damage or defects to the relevant department immediately. If necessary, shut down the machine immediately and secure it.
- Rectify any leaks immediately in accordance with this user manual, paying particular attention to the notes/instructions on handling in accordance with safety requirements.
- ⇨ Chap. "2.1 Handling in accordance with safety requirements", page 14
- ⇨ Chap. "10.3 Troubleshooting", page 156

DANGER

Danger of explosion!
To guarantee safe operation in a hazardous area:

- In its standard model with screw plug, the service connector X10 is not permitted for use in a hazardous area.
- For mounting of the screw plug of the service connector X10, it must be observed that the gasket and the threads of the screw plug as well as the threads in the electronic housing of the valve are not damaged.
- If there is damage to the screw plug of the service connector or the thread in the electronic housing, the valve must not be operated in hazardous areas.
- Tightening torque screw plug:
  a Chap. "3.1.3 Representative depiction of the valve", page 19

DANGER

Danger of explosion!
To guarantee safe operation in a hazardous area:

- The signal interfaces of the valve are implemented with explosion-proof connectors.
- For mounting and removal of the connectors as well as operation of the valve, the notes and instructions in the "Explosion-proof connectors eXLink, CEAG" operating instructions must absolutely be adhered to.
- The eXLink operating instructions from CEAG are in the Appendix to this user manual.

DANGER

Danger of poisoning and injury due to hydraulic fluid squirting out under pressure!
Contact with hydraulic fluids can damage your health (e.g. eye injuries, skin and tissue damage, poisoning in case of inhaling).
- Wear protective gloves and safety glasses.
- If hydraulic fluid gets into your eyes or on your skin, consult a doctor immediately.
- When handling hydraulic fluids, observe the safety provisions applicable to the hydraulic fluid used.

DANGER

Danger of injury due to electric voltage and unexpected movements!
Work on machines that are not shut down presents a danger to life and limb. Work such as mounting or removal, electrical or hydraulic connection, troubleshooting or servicing may only be performed on machines and valves that are shut down.
- Make sure to shut the machine down and switch it off.
- Make sure that the drive motor cannot be switched on.
- For this purpose, switch off the supply voltage as well as that of connected peripherals, such as externally powered transducers or programming units.
- Make sure that all power-transmitting components and connections (electrical and hydraulic) are switched off according to the manufacturer's instructions and secured against switching on again. If possible, remove the main fuse from the machine.
- Make sure that the machine is completely depressurized.

DANGER

Danger of explosion!
Open connectors for the interface must absolutely be covered before start-up.
- The interfaces must be sealed with the original screw plug belonging to the valve.

DANGER

Danger of explosion!
The unsafe operation of the valves is dangerous.
- Only operate the valve when it is in a safe and functional state.
- At least once per shift, check valve for damage visible from the outside and defects such as leakage or damaged cables or connectors.
- The cable glands must be checked at regularly-prescribed intervals. For details, see standard EN 60079-17.
- Report changes, including to the operating behavior, damage, and defects to the responsible department immediately. If necessary, shut down the machine immediately and secure it.
- ⇨ Chap. "2.1 Handling in accordance with safety requirements", page 14
- ⇨ Chap. "10.3 Troubleshooting", page 156

DANGER

Danger of explosion!
An explosion can be triggered by sparks when switching on the machine.

- Open connectors for the interface must absolutely be covered before start-up.
- The eXLink connectors from CEAG must be mounted according to the instructions in the operating instructions for the eXLink connectors.
- In the standard model with a screw plug, the service connector X10 is not permitted for use in a hazardous area.
- The service connector X10 in the standard model M8, 3-pin must be sealed with the original screw plug belonging to the valve before start-up.
- When mounting the screw plug for the service connector X10, make sure that the seal and the thread of the screw plug as well as the thread in the electronic housing of the valve are not damaged.
- In case of damage to the screw plug for the service connector X10 or the threads in the electronic housing, the valve must not be operated.
- Tightening torque for screw plug:
  a Chap. "3.1.3 Representative depiction of the valve", page 19

WARNING

Danger of explosion!
For electrical start-up, cables on the valve, cable glands, screw plugs, and connectors must not be damaged.

- The valve must not be started up with damaged cables, connectors or screw plugs, and it must be sent to us or to one of our authorized service centers immediately.

WARNING

Danger of personal injury and damage to property!
The operation of the valves at pressure that is too high on the hydraulic connections can cause injuries and damage to the machine.

- Pressure-limiting valves or other comparable safety devices, for example, must be installed to limit the pressure at all the hydraulic ports to the specified maximum operating pressure. Maximum operating pressure:
  ⇨ Chap. "11 Technical Data", page 162

WARNING

Risk of injury!
To prevent injuries or other damaging influences on health, suitable protective measures must be taken if necessary prior to and when carrying out any work on the valves or the machine, such as mounting or removing, electrical or hydraulic connection, troubleshooting or servicing, and when handling the valves, accessories, tools or hydraulic fluids.

- a Chap. "2.2 Occupational safety and health", page 15

CAUTION

Danger of personal injury and damage to property!
If the configuration of the valves is changed, valve functions may be changed in such a way as to cause damage, malfunction or failure of the valve or machine.

- Changing the valve configuration during operation is only permissible if this does not cause any dangerous states in the machine or its surroundings.

CAUTION

Danger of personal injury and damage to property!
Working with and on the valves without the required basic mechanical, hydraulic, and electrical knowledge may cause injuries or parts may be damaged.

- Only properly qualified and authorized users may work with and on the valves.
- a Chap. "1.4 Selection and qualification of personnel", page 7

CAUTION

Risk of damage due to dirt and moisture!
This is the only way of adequately protecting the valves against the penetration of dirt and moisture and protecting the gaskets/seals against the effects of ozone and UV.

- The valves must not be transported or stored without their shipping plate fitted.
- The valve shipping plate may only be removed from the valve hydraulic ports directly prior to mounting and must be reinstalled directly after the valve has been removed.
- The shipping plate and the associated fastening elements (screws and nuts) must be kept for later use, e.g. during transportation.

8.1 Preparations

Preparations for start-up

The valves may only be started up when the following is ensured:

- The higher-level machine with all its installed components complies with the latest versions of the relevant national and international regulations, standards, and guidelines (such as the EU Machinery Directive, the ATEX directive, and the regulations of the trade association and of TÜV or VDE).
- The valves and all the other installed components are in a technically fault-free and operationally reliable state.
- No signals that can lead to uncontrolled motions in the machine are transmitted to the valves.

a Chap. "1.3 Intended operation", page 5

8.2 Start-up of the valves

Procedure:

Procedure for Start-up

1. Make sure that all the machine components, connections, and ports conform to the specifications of the machine manufacturer and operator.
2. Prepare the hydraulic system.
   a Chap. "8.4 Filling and flushing the hydraulic system", page 139
3. Establish the valve hydraulic connection.
   a Chap. "6.3 Mounting the valve", page 65
4. Establish the valve electrical connection.
   a Chap. "7.11 General notes on wiring", page 94
5. Valves with field bus interface:
   Connect the valve to the field bus.
6. Make sure that all the mechanical and electrical connections and hydraulic ports are correctly established. The eXLink operating instructions from CEAG are in the Appendix to this user manual.
7. Make sure that the valve is correctly configured, or carry out configuration.
   a Chap. "3.5 Configuration software", page 53
   a Chap. "8.3 Configuration of the valves", page 135
8. Start-up of the hydraulic system.
   a Chap. "8.5 Start-up of the hydraulic system", page 140
9. If necessary, correct the zero position parameters in the valve software.The parameters can be set or interrogated via the service or field bus interface in the valve software. Setting and interrogation can be performed for example with the Moog Valve and Pump Configuration Software.
   For additional information, see User Manual Firmware.

Monitoring the pressure transducer drift

High pressure peaks in the hydraulic system can result in a drift of the valve's internal pressure transducer.
To monitor any possible drift of the valve's pressure transducer, we recommend that the pressure transducer be checked 3, 6 and 12 months after the valve is started up and thereafter at intervals of 6 months. This can be conducted for example using comparison measurements with a calibrated pressure gauge. If necessary, the internal pressure transducer must be recalibrated.
The pressure transducer can be influenced by means of parameters in the valve software. The parameters can be set or interrogated via the service or field bus interface in the valve software. Setting and interrogation can be performed for example with the Moog Valve and Pump Configuration Software.

8.3 Configuration of the valves

Safety instructions: configuration of the valves

CAUTION

Danger of personal injury and damage to property!
If the configuration of the valves is changed, valve functions may be changed in such a way as to cause damage, malfunction or failure of the valve or machine.

- Changing the valve configuration during operation is only permissible if this does not cause any dangerous states in the machine or its surroundings.

CAUTION

Danger of personal injury and damage to property!
The selected settings must be documented after the configuration of the valves has been altered.
The settings can be documented for example with the Moog Valve and Pump Configuration Software.

- After a valve has been repaired or replaced, the user must transfer the settings again to the repaired or new valve because repaired or replacement valves are like new valves delivered with factory settings.
- a Chap. "8.3.3 Factory setting of the valves", page 138
- a Chap. "10.4 Repair", page 160

The Moog Valve and Pump Configuration Software is available as an accessory to simplify start-up, diagnosis and configuration of the valves.
a Chap. "3.6 Moog Valve and Pump Configuration Software", page 54

8.3.1 Configuration via the fieldbus interface

Configuration of the valves via the field bus interface

Valves with field bus interfaces are started up, activated, monitored and configured via the field bus interface (connectors X3 and X4).

8.3.1.1 Configuration with the machine controller

Configuration with the machine controller

To be able to configure the valves with the machine controller, it is necessary to connect the valve to the machine controller via the field bus.

8.3.1.2 Configuration with the Moog Valve and Pump Configuration Software

The Moog Valve and Pump Configuration Software communicates with the valves via the CAN interface. The CAN bus interface is either on the service interface X10 or available on the CAN field bus interface X3 and X4.
a Chap. "7.22 Communication via the Moog Valve and Pump Configuration Software", page 127

8.3.2 Configuration via the service interface

DANGER

Danger of explosion!
To guarantee safe operation in a hazardous area:
- In its standard model with screw plug, the service connector X10 is not permitted for use in a hazardous area.
- For mounting of the screw plug of the service connector X10, it must be observed that the gasket and the threads of the screw plug as well as the threads in the electronic housing of the valve are not damaged.
- If there is damage to the screw plug of the service connector or the thread in the electronic housing, the valve must not be operated in hazardous areas.
- Tightening torque screw plug:
  a Chap. "3.1.3 Representative depiction of the valve", page 19

For the standard model of the valve, the service interface is not suitable for use in hazardous areas. On request, the service interface is available in an explosion-proof model.

Valves without CAN bus interfaces can be started up and configured via the service interface (service connector-X10) with the Moog Valve and Pump Configuration Software.
a Chap. "3.6 Moog Valve and Pump Configuration Software", page 54

Configuration of the valves via the service interface

The following are required to be able to configure the valves with the Moog Valve and Pump Configuration Software via the service interface (service connector X10):

- USB start-up module, not approved for use in hazardous areas
- Configuration/start-up cable
- Adapter for service connector X10, not approved for use in hazardous areas
- PC with installed Moog Valve and Pump Configuration Software

USB starting-up module, configuration/starting-up cable, adapter and Moog Valve and Pump Configuration Software are available as accessories.
a Chap. "12.1 Accessories for valves in the D94xK type series", page 232

To be able to configure the valves via the service interface, it is necessary to connect the valve as follows to the PC with installed Moog Valve and Pump Configuration Software:

Connection of the valve to a PC via the service interface (X10)

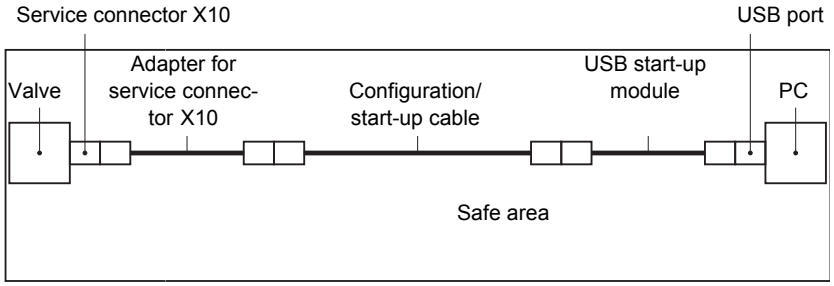


Fig. 52: Connection of the valve to a PC via the service interface (service connector X10)

8.3.3 Factory setting of the valves

Factory setting of the valves

The valve is delivered from the factory with preset parameters. This presetting corresponds to the factory setting of the valves.
Depending on the valve type and model, it may be necessary to adapt the parameters to the respective application.
If the valve is to be incorporated in a field bus, it may also be necessary to adapt the communication parameters.

Please contact Moog or one of its authorized service centers for information on the factory setting parameters.

8.3.4 Storing of parameters

Volatile memory

Modified parameters are initially stored in the volatile memory of the valve electronics microprocessor system, i.e. they are lost if the power supply is interrupted. When the power supply is restored, the parameters that were stored last are again available.

Non-volatile memory

The microprocessor system also has a non-volatile memory. In order to store the modified parameters in this memory, it is necessary to send a memory command to the valve. If the power supply is interrupted, the modified valve configuration will again be available after the supply is restored.

8.4 Filling and flushing the hydraulic system

WARNING

Risk of injury!
In order to prevent injuries and other damage to health when flushing the hydraulic system, please observe the following notes.

- The manufacturer and operator of the machine are responsible for ensuring that, in safety-critical applications, the latest versions of the relevant safety standards, which are designed to prevent damage, are observed.
- Among other things, it is vital to ensure that both the individual components and the entire machine can be put into a safe state.
- If a switching valve is fitted to flush the hydraulic system, this must not cause any dangerous states in the machine.

Procedure for filling and flushing the hydraulic system

Procedure:

1. Depressurize the hydraulic system.
2. Fill the hydraulic system in accordance with the instructions of the manufacturer and the operator of the machine.
   Because new hydraulic fluid is unfiltered, the hydraulic system must be filled via a fill filter with a filter fineness of at least $\beta_{10} \geq 75$ (10 µm absolute).
3. Replace existing filter elements with flushing elements in accordance with the instructions of the manufacturer and the operator of the machine.
4. Remove the proportional valve.
   a Chap. "10.1 Removing of the valves", page 153
5. Instead of the proportional valve, you must install a flushing plate or, if allowed by the hydraulic system, a switching valve.

Use the flushing plate to flush lines P and T.
The switching valve can also be used to flush the actuator with lines A and B.

The flushing plates are not included in the valve scope of delivery.
They are available as an accessory.
a Chap. "12.1 Accessories for valves in the D94xK type series", page 232

6. Carefully flush the hydraulic system in accordance with the instructions of the manufacturer and the operator of the machine. Observe the following when doing so:
   - In order to obtain the best possible flushing effect, make sure the hydraulic fluid reaches operating temperature.
   - Observe the minimum flushing time t:

     $$t = 5 \cdot \frac{V}{Q} \quad [h]$$

     V [l] : Tank capacity
     Q [l/min] : Pump delivery

   - End the flushing process when at least the cleanliness class as specified in the technical data (in accordance with ISO 4406) is achieved:
     18/15/12
7. Depressurize the hydraulic system.
8. Replace flushing elements with suitable filter elements in accordance with the instructions of the manufacturer and the operator of the machine.
9. Remove the flushing plate or switching valve.
10. Mount the proportional valve.
    a Chap. "6.3 Mounting the valve", page 65

8.5 Start-up of the hydraulic system

Procedure:

Procedure for start-up of the hydraulic system

1. Start up the hydraulic system in accordance with the instructions of the manufacturer and the operator of the machine.
2. Vent the hydraulic system in accordance with the instructions of the manufacturer and the operator of the machine.
3. Vent the valve. It may be necessary to repeat the procedure.
4. Check the hydraulic system for external leaks.

8.5.1 Venting

CAUTION

Risk of damage!
Air trapped in the hydraulic system, particularly in the case of high pressure peaks in the system, can cause a diesel effect. If the trapped air bubbles are compressed very quickly and thus heated, this can cause the mixture to self-ignite. This gives rise to a very high increase in pressure and temperature locally, which in turn can result in damage in the hydraulic system, e.g. to gaskets or components, causing the oil to age more quickly.

- In order to avoid diesel effects, the hydraulic system must be ventilated.

8.5.1.1 Tool required

Required tool for venting the valves

The following tool is required for venting the valve:

- Torque wrench for 5 WAF hexagon socket screws

8.5.1.2 Venting the valve and the actuator

WARNING

Risk of injury!
In order to prevent injuries and other damage to health when venting the hydraulic system, please observe the following notes.

- The manufacturer and operator of the machine are responsible for making sure that for safety-critical use, relevant safety standards in the latest version, which serve to avoid damage, are heeded.
- Among other things, it is vital to ensure that both the individual components and the entire machine can be put into a safe state.
- The valve and actuator may only be vented at a low system pressure of max. 10 bar (145 psi).

Procedure for venting the valve and the actuator

Procedure:

1. A low system pressure of max. 10 bar (145 psi) must be applied.
2. Input valve command signals so that the pressure-controlled port is pressurized with system pressure.
3. Carefully open the venting screw by approx. one revolution.
   Position of the venting screw: a Fig. 1, page 19
4. Wait until no additional air escapes or until the escaping hydraulic fluid contains no additional air bubbles.
5. If necessary, tighten venting screw with torque wrench for hexagon socket head cap screws WS 5.
   Tightening torque of the venting screw: 15 Nm.
   Higher tightening torques can result in the destruction of the sealing ring for the venting screw.
6. Remove the escaped hydraulic fluid.
7. If the actuator is higher than the valve, the actuator must likewise be vented at the highest point.

9 Operation

Safety instructions: Operation

DANGER

Danger to life!
Operating machines with damaged or defective components or with a leaking hydraulic system is dangerous and not permitted.

- Before starting up or operating the valves, check the higher-level machine including all its installed components for damage and defects.
- Pay particular attention here to higher-level and hydraulic safety devices such as, for example, EMERGENCY STOP switches and pressure-limiting valves.
- Report damage or defects to the relevant department immediately. If necessary, shut down the machine immediately and secure it.
- Rectify any leaks immediately in accordance with this user manual, paying particular attention to the notes/instructions on handling in accordance with safety requirements.
- ⇨ Chap. "2.1 Handling in accordance with safety requirements", page 14
- ⇨ Chap. "10.3 Troubleshooting", page 156

DANGER

Danger of personal injury and damage to property!
Failure to heed the eXLink operating instructions from CEAG can cause bodily injuries and property damage.

- Follow the eXLink operating instructions from CEAG in the Appendix to this user manual.
- Handle all ex-proof connectors according to the notes and instructions in the eXLink operating instructions from CEAG

DANGER

Danger of injury due to electric voltage and unexpected movements!
Work on machines that are not shut down presents a danger to life and limb. Work such as mounting or removal, electrical or hydraulic connection, troubleshooting or servicing may only be performed on machines and valves that are shut down.

- Make sure to shut the machine down and switch it off.
- Make sure that the drive motor cannot be switched on.
- For this purpose, switch off the supply voltage as well as that of connected peripherals, such as externally powered transducers or programming units.
- Make sure that all power-transmitting components and connections (electrical and hydraulic) are switched off according to the manufacturer's instructions and secured against switching on again. If possible, remove the main fuse from the machine.
- Make sure that the machine is completely depressurized.

DANGER

Danger of explosion!
The unsafe operation of the valves is dangerous.
- Only operate the valve when it is in a safe and functional state.
- At least once per shift, check valve for damage visible from the outside and defects such as leakage or damaged cables or connectors.
- The cable glands must be checked at regularly-prescribed intervals. For details, see standard EN 60079-17.
- Report changes, including to the operating behavior, damage, and defects to the responsible department immediately. If necessary, shut down the machine immediately and secure it.
- ⇨ Chap. "2.1 Handling in accordance with safety requirements", page 14
- ⇨ Chap. "10.3 Troubleshooting", page 156

DANGER

Danger of explosion!
The unsafe operation of the valves is dangerous.
- Open connectors for the interfaces must absolutely be covered before start-up.
- The eXLink connectors from CEAG must be mounted correctly according to the instructions in the "Ex plug connector eXLink" operating instructions. Here the instructions and notes in the operating instructions for the connectors must be heeded.
- Only use the service connector X10 in the M8 mode., 3-pin outside the hazardous area.
- The service connector X10 in the standard model M8, 3-pin must be sealed with the original screw plug belonging to the valve before start-up.
- For a configuration of the valve within the hazardous area, on request there is the X10 interface with an appropriate Ex-protected plug connector.

DANGER

Danger of explosion due to impermissible heating up of the valve!
As a result of insufficient ventilation of the valve or deposits on the valve, the impermissible heating up of the valve can be such that the maximum temperatures of the certified temperature classes are exceeded.
- The valves must be checked regularly, cleaned if necessary. Deposits on the valve must be removed.
- If necessary inform the responsible person immediately and remove the valve from electrical and hydraulic operation.

WARNING

Danger of explosion!
During operation, cables on the valve, cable glands, screw plugs, and connectors must not be damaged.

- The valve must not be started up with damaged cables, connectors or screw plugs, and it must be sent to us or to one of our authorized service centers immediately.

WARNING

Risk of injury!
To prevent injuries or other damaging influences on health, suitable protective measures must be taken if necessary prior to and when carrying out any work on the valves or the machine, such as mounting or removing, electrical or hydraulic connection, troubleshooting or servicing, and when handling the valves, accessories, tools or hydraulic fluids.

- a Chap. "2.2 Occupational safety and health", page 15

CAUTION

Danger of personal injury and damage to property!
To avoid damage or leaks, the following tasks must be performed at regular intervals in accordance with the instructions of the manufacturer and the operator of the machine:

- Checking the valve and the hydraulic system for externally identifiable damage and defects.
- Checking for loose plugs/connectors.
- Checking the cleanliness level of the hydraulic fluid.
- Checking the port O-rings for elasticity, integrity and correct seating.
- a Chap. "10.2.1 Checking and replacing the port O-rings", page 155

CAUTION

Danger of personal injury and damage to property!
If the configuration of the valves is changed, valve functions may be changed in such a way as to cause damage, malfunction or failure of the valve or machine.

- Changing the valve configuration during operation is only permissible if this does not cause any dangerous states in the machine or its surroundings.

CAUTION

Danger of personal injury and damage to property!
It is not permitted to operate the Moog Valve and Pump Configuration Software on a fieldbus while the machine is running.
It is only permitted to activate valves via the Moog Valve and Pump Configuration Software if this does not cause any dangerous states in the machine and in its surroundings.

CAUTION

Danger of personal injury and damage to property!
Working with and on the valves without the required basic mechanical, hydraulic, and electrical knowledge may cause injuries or parts may be damaged.
- Only properly qualified and authorized users may work with and on the valves.
- a Chap. "1.4 Selection and qualification of personnel", page 7

CAUTION

Risk of damage!
In order to prevent damage to the valves or to the machine, the following must be observed:
- Values specified in the technical data must be adhered to.
- Values specified on the nameplate must be adhered to.
- a Chap. "11 Technical Data", page 162

9.1 Preparations for operation

Preparations for valve operation

The valves may only be operated as a component part of a higher-level overall system, for example in a machine.
a Chap. "1.3 Intended operation", page 5

The following must be completed before the valve is operated:

- Qualified project planning
- Correct start-up and configuration of the valve
  a Chap. "8 Start-up", page 129

9.2 Operation of the valve

Operation of the valve: activation via signals from the machine controller

The valve is activated via signals that it receives from the machine controller.
Direct interventions by the user on the valve during normal operation are not necessary.
The device may only be operated in a safe and functional state.
At least once per shift, check valve for damage visible from the outside and defects such as leakage or damaged cables or connectors. Report changes, including to the operating behavior to the responsible department immediately.
If necessary, shut the system down immediately and secure it!
If necessary, shut the system down immediately and secure it!
Eliminate the fault immediately.
The valve has no controls, such as e.g. switches or buttons, which must be actuated.

Switching of the valve to standby or fail-safe state can also be triggered by corresponding signals at the enable input of connector X1:

- Signals between 8.5 V and 32 V based on GND at the enable input switch the valve to standby.
- Signals lower than 6.5 V at the enable input switch the valve to fail-safe state.

a Chap. "3.4.3 Digital enable input", page 52

Monitoring the pressure transducer drift

High pressure peaks in the hydraulic system can result in a drift of the valve's internal pressure transducer.
To monitor any possible drift of the valve's pressure transducer, we recommend that the pressure transducer be checked 3, 6 and 12 months after the valve is started up and thereafter at intervals of 6 months. This can be conducted for example using comparison measurements with a calibrated pressure gauge. If necessary, the internal pressure transducer must be recalibrated.
The pressure transducer can be influenced by means of parameters in the valve software. The parameters can be set or interrogated via the service or field bus interface in the valve software. Setting and interrogation can be performed for example with the Moog Valve and Pump Configuration Software.

Information on maintenance:
a Chap. "10.2 Maintenance", page 155

Information on correcting possible faults:
a Chap. "10.3 Troubleshooting", page 156

9.3 Shutting down the valve

Safety notes: Shutting down the valve

DANGER

Danger to life!
Hydraulic pressure and electrical supply voltage are still normally applied after the valve has been shut down. The machine is not automatically put out of operation when the valve is shut down.

DANGER

Danger of poisoning and injury due to hydraulic fluid squirting out under pressure!
Contact with hydraulic fluids can damage your health (e.g. eye injuries, skin and tissue damage, poisoning in case of inhaling).

- Wear protective gloves and safety glasses.
- If hydraulic fluid gets into your eyes or on your skin, consult a doctor immediately.
- When handling hydraulic fluids, observe the safety provisions applicable to the hydraulic fluid used.

DANGER

Danger of injury due to electric voltage and unexpected movements!
Work on machines that are not shut down presents a danger to life and limb. Work such as mounting or removal, electrical or hydraulic connection, troubleshooting or servicing may only be performed on machines and valves that are shut down.

- Make sure to shut the machine down and switch it off.
- Make sure that the drive motor cannot be switched on.
- For this purpose, switch off the supply voltage as well as that of connected peripherals, such as externally powered transducers or programming units.
- Make sure that all power-transmitting components and connections (electrical and hydraulic) are switched off according to the manufacturer's instructions and secured against switching on again. If possible, remove the main fuse from the machine.
- Make sure that the machine is completely depressurized.

Shutting down the valve

The valve can be shut down as follows:

- Switching off of the supply voltage
- Adoption by the valve of the 'DISABLED' and 'INIT' valve states
- Signal < 6.5 V at the enable input of connector X1 (valve-dependent)

a Chap. "3.2.3 Fail-safe events", page 30

If necessary, the valve must be restarted after it has been shut down or has entered the fail-safe state.
a Chap. "3.2.4 Restarting the valve", page 33

10 Service

Safety instructions: Service

DANGER

Danger to life!
Operating machines with damaged or defective components or with a leaking hydraulic system is dangerous and not permitted.

- Before starting up or operating the valves, check the higher-level machine including all its installed components for damage and defects.
- Pay particular attention here to higher-level and hydraulic safety devices such as, for example, EMERGENCY STOP switches and pressure-limiting valves.
- Report damage or defects to the relevant department immediately. If necessary, shut down the machine immediately and secure it.
- Rectify any leaks immediately in accordance with this user manual, paying particular attention to the notes/instructions on handling in accordance with safety requirements.
- ⇨ Chap. "2.1 Handling in accordance with safety requirements", page 14
- ⇨ Chap. "10.3 Troubleshooting", page 156

DANGER

Danger of explosion!
To guarantee safe operation in a hazardous area:

- The signal interfaces of the valve are implemented with explosion-proof connectors.
- For mounting and removal of the connectors as well as operation of the valve, the notes and instructions in the "Explosion-proof connectors eXLink, CEAG" operating instructions must absolutely be adhered to.
- The eXLink operating instructions from CEAG are in the Appendix to this user manual.

DANGER

Danger of poisoning and injury due to hydraulic fluid squirting out under pressure!
Contact with hydraulic fluids can damage your health (e.g. eye injuries, skin and tissue damage, poisoning in case of inhaling).

- Wear protective gloves and safety glasses.
- If hydraulic fluid gets into your eyes or on your skin, consult a doctor immediately.
- When handling hydraulic fluids, observe the safety provisions applicable to the hydraulic fluid used.

DANGER

Danger of explosion due to impermissible heating up of the valve!
As a result of insufficient ventilation of the valve or deposits on the valve, the impermissible heating up of the valve can be such that the maximum temperatures of the certified temperature classes are exceeded.

- The valves must be checked regularly, cleaned if necessary. Deposits on the valve must be removed.
- If necessary inform the responsible person immediately and remove the valve from electrical and hydraulic operation.

DANGER

Danger of injury due to electric voltage and unexpected movements!
Work on machines that are not shut down presents a danger to life and limb. Work such as mounting or removal, electrical or hydraulic connection, troubleshooting or servicing may only be performed on machines and valves that are shut down.

- Make sure to shut the machine down and switch it off.
- Make sure that the drive motor cannot be switched on.
- For this purpose, switch off the supply voltage as well as that of connected peripherals, such as externally powered transducers or programming units.
- Make sure that all power-transmitting components and connections (electrical and hydraulic) are switched off according to the manufacturer's instructions and secured against switching on again. If possible, remove the main fuse from the machine.
- Make sure that the machine is completely depressurized.

DANGER

Danger of explosion!
To guarantee safe operation in a hazardous area:

- In its standard model with screw plug, the service connector X10 is not permitted for use in a hazardous area.
- For mounting of the screw plug of the service connector X10, it must be observed that the gasket and the threads of the screw plug as well as the threads in the electronic housing of the valve are not damaged.
- If there is damage to the screw plug of the service connector or the thread in the electronic housing, the valve must not be operated in hazardous areas.
- Tightening torque screw plug:
  a Chap. "3.1.3 Representative depiction of the valve", page 19

DANGER

Danger of explosion!
The unsafe operation of the valves is dangerous.
- Only operate the valve when it is in a safe and functional state.
- At least once per shift, check valve for damage visible from the outside and defects such as leakage or damaged cables or connectors.
- The cable glands must be checked at regularly-prescribed intervals. For details, see standard EN 60079-17.
- Report changes, including to the operating behavior, damage, and defects to the responsible department immediately. If necessary, shut down the machine immediately and secure it.
- ⇨ Chap. "2.1 Handling in accordance with safety requirements", page 14
- ⇨ Chap. "10.3 Troubleshooting", page 156

WARNING

Risk of injury!
To prevent injuries or other damaging influences on health, suitable protective measures must be taken if necessary prior to and when carrying out any work on the valves or the machine, such as mounting or removing, electrical or hydraulic connection, troubleshooting or servicing, and when handling the valves, accessories, tools or hydraulic fluids.
- a Chap. "2.2 Occupational safety and health", page 15

WARNING

Danger of explosion!
During shut-down, cables on the valve, cable glands, screw plugs, and connectors must not be damaged.
- The valve must not be started up with damaged cables, connectors or screw plugs, and it must be sent to us or to one of our authorized service centers immediately.

CAUTION

Danger of personal and property damage due to defective accessories and defective spare parts!
Unsuitable or defective accessories or unsuitable or defective spare parts may cause damage, malfunctions or failure of the valve or the machine.
- Use only original accessories and original spare parts.
- a Chap. "12 Accessories, Spare Parts, and Tools", page 232
- Warranty and liability claims for personal injury and damage to property are among other things excluded if they are caused by the use of unsuitable or defective accessories or unsuitable or defective spare parts.
- a Chap. "1.8 Warranty and liability", page 11

CAUTION

Risk of damage!
The plugs, connectors, and connection cables of the valves may not be used for other purposes, such as for stepping on or as transport holders.

CAUTION

Danger of personal injury and damage to property!
Working with and on the valves without the required basic mechanical, hydraulic, and electrical knowledge may cause injuries or parts may be damaged.

- Only properly qualified and authorized users may work with and on the valves.
- a Chap. "1.4 Selection and qualification of personnel", page 7

CAUTION

Risk of damage!
In order to prevent damage to the valves or to the accessories:

- The plugs, connectors, and connection cables of the valves may not be used for other purposes, such as for stepping on or as transport holders.
- Due to the complexity of the internal components of the valves and of accessories, only we or our authorized service centers may make repairs and perform maintenance work other than that explained in this user manual.
- Warranty and liability claims for personal injury and damage to property are excluded among other things if they are caused by unauthorized repairs or other unauthorized interventions.
- ⇨ Chap. "1.8 Warranty and liability", page 11
- Structural changes to or opening of explosion-proof valves are not permitted since these invalidate the ex certification.

10.1 Removing of the valves

10.1.1 Tools and materials required

Tools and materials required for removing

The following tools and materials are required for removing the valves:

- For removing and mounting the valve
  Torque wrench for hexagon socket head cap screws
- Replacement for O-rings of ports to be replaced if necessary
- A shipping plate and the associated attachment elements
- For mounting the shipping plate
  Wrench for hexagon socket head cap screws or regular screwdriver (only valve D941K) and, if necessary, wrench

CAUTION

Danger of personal injury and damage to property!
Failure to heed the eXLink operating instructions from CEAG can cause bodily injuries and property damage.

- Follow the eXLink operating instructions from CEAG in the Appendix to this user manual.
- Handle all ex-protected connectors according to the notes and instructions in the eXLink operating instructions from CEAG

Structural changes to or opening of explosion-proof valves are not permitted since these invalidate the ex certification.

Installation screws

The installation screws and the O-rings to be replaced if necessary are not included in the scope of delivery for the valves. They are available as an accessory.
a Chap. "12 Accessories, Spare Parts, and Tools", page 232
The wrench sizes of the hexagon socket cap head screws for mounting are type series-specific.
Details about the screws and their tightening torque:
a Tab. 8, page 65

Attachment screws

The fastening screws for the transport plates are type-specific.
Details about fastening screws and their tightening torque:
a Chap. "12 Accessories, Spare Parts, and Tools", page 232

10.1.2 Removing

Safety instructions: Removing of the valves

CAUTION

Risk of damage due to dirt and moisture!
This is the only way of adequately protecting the valves against the penetration of dirt and moisture and protecting the gaskets/ seals against the effects of ozone and UV.

- The valves must not be transported or stored without their shipping plate fitted.
- The valve shipping plate may only be removed from the valve hydraulic ports directly prior to mounting and must be reinstalled directly after the valve has been removed.
- The shipping plate and the associated fastening elements (screws and nuts) must be kept for later use, e.g. during transportation.

Procedure for removing the valve

Procedure:

1. Shut down and switch off the machine and put it into a de-energized and depressurized state.

For the removal of the ex-protected connectors, the notes and instructions for the eXLink operating instructions of CEAG must be heeded.
The eXLink operating instructions from CEAG are in the Appendix to this user manual.

2. Disconnect the connectors of the Ex-protected connectors.
3. Release the valve's installation screws.
4. Remove the valve from the mounting surface.
5. Check the Check that O-rings in the valve ports (P, A, B, X, Y and T) are present and for elasticity, integrity and correct seating.
6. Replace hardened and damaged O-rings with new O-rings.
7. Attach the shipping plate to the valve's hydraulic ports.
   The tightening torque of the attachment screws for the shipping plate is series-specific.
   Benchmark value: 30% of the value that is specified in table "Specification for installation screws for the valves"
   a Tab. 8, page 65
8. If the valve is not to be immediately reused or is to be serviced: keep valve in original packaging.
   a Chap. "5 Transportation and Storage", page 59
9. If necessary, seal the ports of the hydraulic system to prevent the hydraulic fluid from being contaminated.

10.2 Maintenance

Embrittlement of the gasket materials

Changes in temperature, effects of the hydraulic fluid, such as, pressure peaks, and similar influences can, depending on the application, expose the gasket/seal materials to different levels of wear, and this in turn may cause leaks.

In order to avoid possible resulting impairments or damage, we recommend that the valve, after a period of storage or operation of more than 5 years, be inspected by us or one of our authorized service centers.

Maintenance work by the user on explosion proof valves is not permitted. Intervention by third parties will invalidate the ex certification.

If the valve is exposed to high loads, it may be necessary to reduce the check/inspection interval to suit the application.

10.2.1 Checking and replacing the port O-rings

10.2.1.1 Tools and materials required

Tools and materials required for checking and replacing the O-rings

The following are required for checking and replacing the port O-rings:

- For removing and mounting the valve
  Torque wrench for hexagon socket head cap screws
- Replacement for O-rings of ports to be replaced if necessary
  a Chap. "12 Accessories, Spare Parts, and Tools", page 232

Installation screws

The installation screws and the O-rings to be replaced if necessary are not included in the scope of delivery for the valves. They are available as an accessory.
a Chap. "12 Accessories, Spare Parts, and Tools", page 232
The wrench sizes of the hexagon socket cap head screws for mounting are type series-specific.
Details about the screws and their tightening torque:
a Tab. 8, page 65

10.2.1.2 checking and replacing the O-rings

Procedure for checking and replacing the O-rings

Procedure:

1. Remove the valve.
   a Chap. "10.1 Removing of the valves", page 153
2. Check that O-rings in the valve ports (P, A, B, and T, etc.) are present and for elasticity, integrity and correct seating.
3. Replace hardened and damaged O-rings with new O-rings.
4. Remount the valve.
   a Chap. "6.3 Mounting the valve", page 65

10.2.2 Monitoring the pressure transducer drift

Monitoring the pressure transducer drift

High pressure peaks in the hydraulic system can result in a drift of the valve's internal pressure transducer.
To monitor any possible drift of the valve's pressure transducer, we recommend that the pressure transducer be checked 3, 6 and 12 months after the valve is started up and thereafter at intervals of 6 months. This can be conducted for example using comparison measurements with a calibrated pressure gauge. If necessary, the internal pressure transducer must be recalibrated.
The pressure transducer can be influenced by means of parameters in the valve software. The parameters can be set or interrogated via the service or field bus interface in the valve software. Setting and interrogation can be performed for example with the Moog Valve and Pump Configuration Software.

10.3 Troubleshooting

Possible faults

The following faults may occur:

- Leak at the valve connecting surface
  a Chap. "10.3.1.1 Leak at the valve connecting surface", page 157
- Leak at the linear force motor screw plug
  a Chap. "10.3.1.2 Leak at the linear force motor screw plug", page 157
- No hydraulic response by the valve
  a Chap. "10.3.2 No hydraulic response by the valve", page 158
- Instability of the control loops
  a Chap. "10.3.3 Instability of the external control loop", page 158
  a Chap. "10.3.4 Instability of the internal valve control loops", page 159

If the fault cannot be corrected by means of the measures set out below, please contact us or one of our authorized service centers.

Restarting after correcting the fault

After correcting the fault, if necessary reinstall and restart the valve.
a Chap. "6.3 Mounting the valve", page 65
a Chap. "3.2.4 Restarting the valve", page 33

10.3.1 Leaks

10.3.1.1 Leak at the valve connecting surface

Leak at the valve connecting surface

Measures:

- Check that O-rings in the valve ports (P, A, B, X, Y and T) are present and for elasticity, integrity and correct seating.
  If necessary, install O-rings, replace or correct the seating.
- Check the valve's mounting and connecting surfaces, the valve and the hydraulic system for damage, contamination and evenness.
- Check installation screws for secure and correct seating.
  Re-tighten screws if necessary with the Torque wrench for hexagon socket head cap screws.

The wrench sizes of the hexagon socket cap head screws for mounting are type series-specific.
Details about fastening screws and their tightening torque:
a Tab. 8, page 65

10.3.1.2 Leak at the linear force motor screw plug

CAUTION

- In the event of a leak at the linear force motor screw plug, have the valve check by Moog or one of its authorized service centers.

10.3.1.3 Leak at the venting screw

Leak at the venting screw

Measures:

- Check that the sealing ring on the venting screw is present and for elasticity, integrity and correct seating.
  If necessary, install the sealing ring, replace or correct the seating.
  If necessary, use a new screw.
- Check the venting screws for secure and correct seating.
  If necessary, tighten screws with torque wrench for hexagon socket head cap screws WS 5.
  Tightening torque of the venting screw: 6 Nm.
  Higher tightening torques can result in the destruction of the sealing ring for the venting screw.
- Check the valve's mounting and connecting surfaces, the valve and the hydraulic system for damage, contamination and evenness.

10.3.2 No hydraulic response by the valve

No hydraulic response by the valve

DANGER

Danger to life!
Touching electrically live parts can cause electric shock.
▶ Touching electrically live parts must therefore be avoided.

Measures:

- Check whether all the machine components, connections, and ports conform to the specifications of the manufacturer and operator.
  To do so, on the valves compare the data on the nameplate with the specifications. (The details on the type plate correspond to the performance requirements ordered. They may have changed due to configuration.)
- Check whether the hydraulic installation is correct and whether all the hydraulic ports are correctly established.
- Check whether hydraulic pressure is present.
- Check whether the hydraulic supply to the pilot stage is present or correctly configured (pilot mode: external or internal).
- Check whether the supply voltage is present.
- Check whether the connectors are correctly attached and non-corroded.
- Check whether there is a command signal failure or a faulty electric cable.
- Check whether the command signal is analog or applied via the field bus interface (depending on the model).
- Check whether the valve is in a fault state.
  If necessary, correct the fault and then cancel the fault via the fieldbus or reset the valve by switching the supply voltage off and then on again.

  Typical fault causes:
  - Supply voltage dips below 18 V
    Electrical data: a Chap. "11 Technical Data", page 162
  - Control error (for example, due to the spool sticking, which can be caused for instance by contamination)
  - No command signal (e.g., due to open circuit)
- Check whether the enable signal is applied. If there is no enable, the valve cannot be rendered in the 'ACTIVE' valve status.
- Check whether the configuration of the internal valve software is correct.

10.3.3 Instability of the external control loop

Instability of the external control loop

Measures:

- Check whether the system pressure is stable.
  If necessary, reduce control loop gain.
- Check whether the internal valve control loops are stable.
  a Chap. "10.3.4 Instability of the internal valve control loops", page 159
- Check whether the controlled system was modified.

10.3.4 Instability of the internal valve control loops

10.3.4.1 Flow control

Instability of the internal valve control loops: Flow control

Measures:

- Check whether the signal quality of the command signals is sufficient.
- Check whether the system and pilot pressures are stable.
- Check whether the quality and purity of the hydraulic fluid used conforms to the specifications of the manufacturer and the operator of the machine.
- Check whether the valve is operational.
  To do so, perform a comparison of the command/actual value signals.

10.3.4.2 Pressure control

Instability of the internal valve control loops: pressure function

Measures:

- Check whether the signal quality of the command signals is sufficient.
- Check whether the system pressure is stable.
- Check whether the system and pilot pressures are stable.
- Vent the valve or the hydraulic system.
  a Chap. "8.5.1 Venting", page 140
- Optimize the control loop gain of the pressure controller by adapting the parameters (P, I, D, etc.).
  a Chap. "3.3.5 Notes on the pressure controller control response", page 42
- Check whether the quality and purity of the hydraulic fluid used conforms to the specifications of the manufacturer and the operator of the machine.
- Check whether the valve is operational.
  To do so, switch to flow control (Q-control) via the integrated service or field bus interface and perform a comparison of the command and actual value signals.
- Check whether the pressure controlled system has been modified.
- Check whether the pressure in T is below the pressure to be controlled.

10.4 Repair

Safety instructions: Repair

CAUTION

Danger of personal injury and damage to property!
Repaired valves or replacement valves are, like new valves, delivered with the factory settings. In the event of a repair job for defective valves, we and our authorized service centers shall not accept liability for software and data installed by the customer.

- Check the valves for correct mechanical design and correct configuration before start-up.

CAUTION

Danger of personal injury and damage to property!
If the configuration of the valves is changed, valve functions may be changed in such a way as to cause damage, malfunction or failure of the valve or machine.

- Changing the valve configuration during operation is only permissible if this does not cause any dangerous states in the machine or its surroundings.

Maintenance work by the user on explosion proof valves is not permitted. Intervention by third parties will invalidate the ex certification.

Moog Global Support

Moog Global Support™ provides professional repair and corrective maintenance services on the highest level thanks to our experienced technicians. Our customer service and our professional expertise ensure that your systems will always remain in an optimal state. Here we offer the reliability that you can only expect from leading manufacturers with worldwide branch offices.

MOOG Global Support Logo

Fig. 53: MOOG Global Support Logo

WARNING

Risk of damage!
To guarantee safe operation in hazardous areas, the following points must be heeded:

- Maintenance work on ex-protected valves may only be performed by us or our authorized service centers.
- Intervention by third parties will invalidate the Ex certification.

Your advantages:

- Shorter downtimes, critical systems can be operated permanently with high performance
- Investment security thanks to reliability, adaptability, and guaranteed life span of our products
- Optimized corrective maintenance planning and system set-up
- Use of our flexible corrective maintenance program according to your service requirements

Our service offerings:

- Repair with original parts by trained technicians according to the latest Moog specifications
- Provision of original spare parts and products in order to avoid unplanned downtimes
- Flexible programs according to your needs for preventative corrective maintenance and set-up thanks to annual or multi-year contracts
- On-site service for start-up, set-up, and fault diagnosis
- Reliable service with equally good quantity worldwide

For additional information about **Moog Global Support™**, visit

http://www.moog.com/industrial/service

Maintenance work by the user on explosion-proof valves is not permitted. Intervention by third parties will invalidate the ex certification.

In the event of a repair job for defective valves, we and our authorized service centers reserve the right to perform a repair or, after consultation, alternatively to supply replacement valves with an identical or compatible equipment specification.

11 Technical Data

CAUTION

Risk of damage!
In order to prevent damage to the valves or to the machine, the following must be observed:
- Values specified in the technical data must be adhered to.
- Values specified on the nameplate must be adhered to.
- a Chap. "11 Technical Data", page 162

CAUTION

Risk of damage!
In order to prevent damage to the valves or to the machine, observe the following points:
- Do not immerse the valves in liquids.

Technical data for D941K to D945K, overview

Description	Chapter, page
Nameplates Description of the functions of the valve, which are specified in the model number and type designation.	a Chap. 11.1, page 164
Electromagnetic compatibility (EMC)	a Chap. 11.2, page 173
Dimensions of the connector	a Chap. 7.3, page 74
Technical data D941K – ISO 4401-05/NG10 - Technical data - Installation drawing/dimensions - Characteristic curves - Way functions and hydraulic symbols	a Chap. 11.3, page 174
Two-stage digital proportional valve, D941K type series, with direct-operated pilot valve D633K	a Chap. 11.3, page 174
Technical data D942K – ISO 4401-07/NG16 - Technical data - Installation drawing/dimensions - Characteristic curves - Way functions and hydraulic symbols	a Chap. 11.4, page 185
Two-stage digital proportional valve, D942K type series, with direct-operated pilot valve D633K	a Chap. 11.4.2, page 187

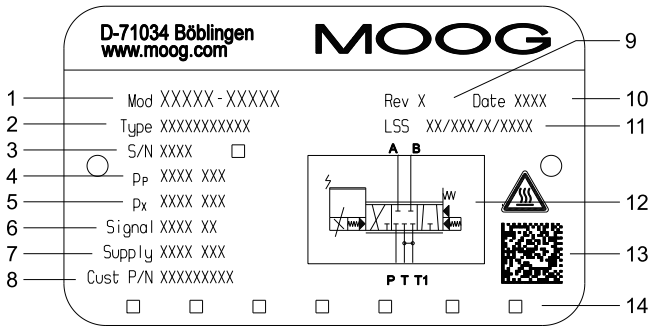
Tab. 25: Overview of technical data for the series and variants (Part 1 of 2)

Technical data D943K – ISO 4401-08/NG25 - Technical data - Installation drawing/dimensions - Characteristic curves - Way functions and hydraulic symbols	a Chap. 11.5, page 196
Two-stage digital proportional valve, D943K type series, with direct-operated pilot valve D633K	a Chap. 11.5.2, page 198
Technical data D944K – ISO 4401-08/NG25 - Technical data - Installation drawing/dimensions - Characteristic curves - Way functions and hydraulic symbols	a Chap. 11.6, page 207
Two-stage digital proportional valve, D944K type series, with direct-operated pilot valve D633K	a Chap. 11.6.2, page 209
Technical data D945K – ISO 4401-10/NG32 - Technical data - Installation drawing/dimensions - Characteristic curves - Way functions and hydraulic symbols	a Chap. 11.7, page 218
Two-stage digital proportional valve, D945K type series, with direct-operated pilot valve D633K	a Chap. 11.7.2, page 220

Tab. 25: Overview of technical data for the series and variants (Part 2 of 2)

11.1 Nameplates

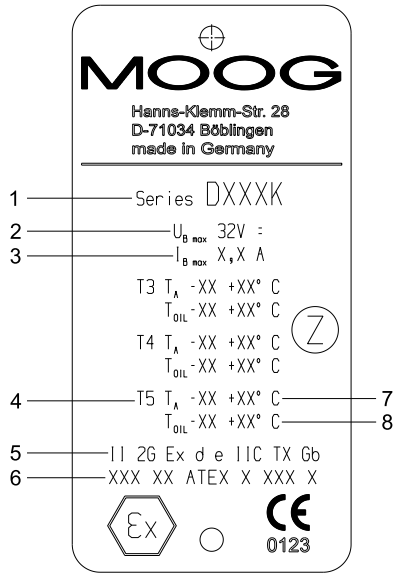
Nameplate (example for NG10)



Item	Designation	Additional information
1	Model number	a Chap. "11.1.1 Model number and type designation", page 166
2	Type designation	a Chap. "1.2 Supplemental documents", page 5
3	Serial number	
4	Maximum operating pressure	Hydraulic data (series-specific) a Chap. "11 Technical Data", page 162 (table)
5	Pilot pressure	a Chap. "3.3.3 Control type ports X and Y", page 41 a Chap. "3.3.1.1 Flow control (Q-control)", page 35
6	Signal type for analog command inputs	a Chap. "3.4.1.1 Signal type identification", page 45
7	Supply voltage	see type designation: a Chap. "11.1 Nameplates", Digit 11, Supply voltage, page 171 Pin assignment of the connector X1: a Chap. "7.4.1 Pin assignment of connector X1", page 76
8	Optional customer-specific designation	
9	Optional version identification	
10	Date of manufacture in MM/YY format	
11	LSS address (decimal)	a Chap. "11.1.2 LSS address", page 173
12	Hydraulic symbol	
13	Data matrix code	a Chap. "11.1.3 Data matrix code", page 173
14 (only NG10)	Designation of ports	

Fig. 54: Nameplate (example)

Ex nameplate



Item	Designation	Additional information
1	Series	
2	Power supply	
3	Current consumption	
4	Temperature class	T5
5	Identification	
6	Certification	
7	Ambient temperature	T_A for temperature class from item 4
8	Fluid temperature	T_{oil} for temperature class from item 4

Fig. 55: Ex nameplate (example)

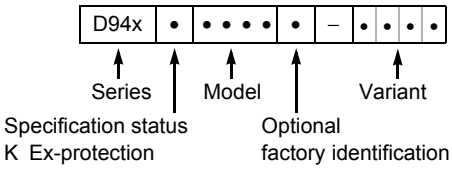
The ambient and fluid temperatures may not exceed the values of the respective temperature classes.

11.1.1 Model number and type designation

When ordering the valve, its functions are specified and given in model number and the type designation.

The model number is set out as follows:

Model number



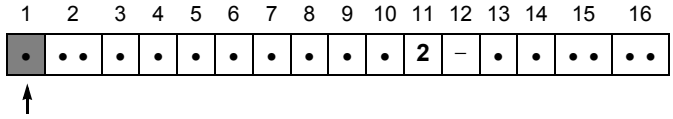
Type designation

The 16-digit type designation specifies the delivery state of the valve.
By changing the valve configuration, it is possible to change the valve in such a way that it no longer conforms to this status.

Which signal type is currently set can be ascertained for example with the Moog Valve and Pump Configuration Software.

The 2nd, 15th, and 16th digit of the type designation consist of two characters. The 15th and 16th digits are specified by the factory.

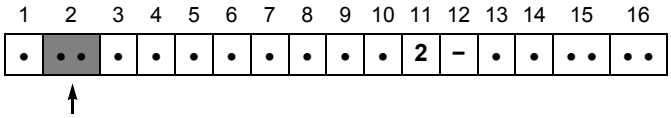
Digit 1
spool type



The 1st digit of the type designation of the valve provides information about the type of spool.

Variant	Spool type	Series
P	Standard spool	D941 to D945
B	Standard spool (5-way)	D941 (with P_1 port)

Tab. 26: Spool type in the type designation

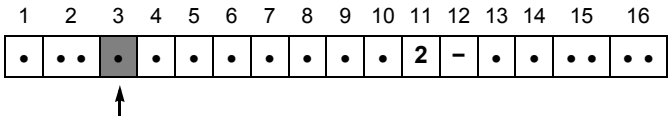


Digit 2
Rated flow Q_N

The 2nd digit of the type designation of the valve provides information about the rated flow Q_N (at Δp_N = 5 bar (72.5 psi) per control land: tolerance ±10 %)

Variant	Rated flow[l/min]	Series
30	30	D941K
60	60	D941K
80	80	D941K
01	150	D942K
02	250	D942K
03	350	D943K
05	550	D944K
10	1000	D945K
15	1500	D945K

Tab. 27: Rated flow variant in the type designation



Digit 3
pressure range identification

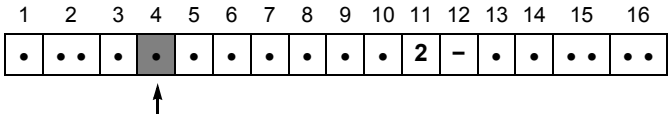
The pressure range identification, i.e. the 3rd position in the valve type designation, indicates what maximum operating pressure is permissible in port A.

With internal control connection X, the maximum operating pressure corresponds to the maximum pilot pressure. The control parameters of the valve electronics are adjusted to the control pressure.

Ident.	Maximum operating pressure in port A	Series D94xK	
		p	pQ
W	25 bar (363 psi)	•	•
V	100 bar (1,450 psi)	•	•
U	160 bar (2,320 psi)	•	•
T	250 bar (3,625 psi)	•	•
K	350 bar (5,075 psi)	•	•
X	Special version	•	•

Tab. 28: Pressure range identification in the type designation

The pressure controlled with a pressure command of 100 % in port A can, depending on the application, deviate from the maximum operating pressure and be set by the customer.

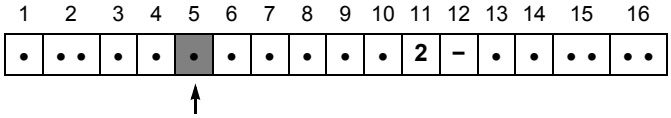


Digit 4
Spool

The 4th digit of the valve's type designation provides information about which version of the spool is integrated into the valve.

Variant	Valve configuration	Bushing-spool version
A	4-way	≈ zero overlap, linear characteristic curve
D	4-way	10 % positive overlap, linear characteristic curve
R	4-way	10 % positive overlap, kinked characteristic curve
Q	5-way	Valve opening: P→A and P_1→B and A→T 5 % positive overlap, linear characteristic curve (only D941K-B)
Y	4-way	≈ zero overlap, dual gain flow characteristic
Z	2/2-way	Valve opening: A→T and B→T_1 (D941K) Valve opening: P→B and T→A only with port X and Y external (D942K to D945K)
X		Special spool on request

Tab. 29: Spool variant in the type designation

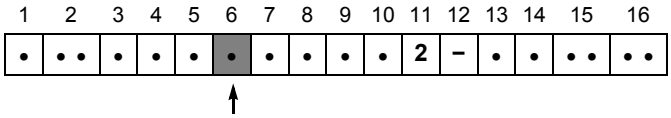


Digit 5
Pilot valve

The 5th digit of the valve's type designation provides information about which version of the pilot valve is integrated into the valve.

Variant	Pilot valve		Series
S	Single-stage drive pilot valve D633K		D941K to D945K

Tab. 30: Pilot valve variant in the type designation



Digit 6
Fail-safe variant

The 6th digit of the valve's type designation provides information about which mechanical fail-safe function is integrated into the valve.

Fail-safe state in case of failure, tables

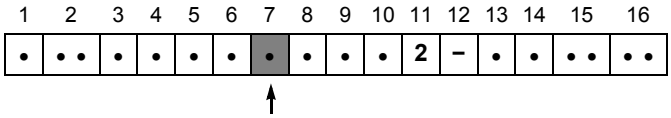
The following table describes the spool positions of the main stage in case of failure of the valve electronics, the control pressure or the control pressure of the optional 4/2-way valve of the D94xK valve with the D633K pilot valve.

Position of the spool of the main stage in case of failure, D94xK valves with direct-operated pilot valve D633K

Fail-safe Function	Spool position of the Main stage	Pilot pressure[1]	Supply voltage	
			Valve Electronics	4/2-way seat valve
F	End position: P→B and A→T	ON:	off	-
	undefined	off	ON:	-
	End position: P→B and A→T	off	off	-
D	End position: P→A and B→T (D941K: approx. 20 % P→A and B→T	ON:	off	-
	undefined	off	ON:	-
	End position: P⇨A and B→T (D941K: approx. 20 % P→A and B→T	off	off	-
K	undefined	ON:	off	ON:
		off	ON:	ON:
		off	off	ON:
	Defined middle position	ON:	off	off
		off	ON:	off
		off	off	off
H	End position: P→B and A→T	ON:	off	ON:
	undefined	off	ON:	ON:
	Defined middle position and defined P→B and A→T	off	off	ON:
		ON:	off	off
		off	ON:	off
		off	off	off

Tab. 31: Spool position in case of failure, D94xK with pilot valve D633K

All other combinations of pressure and supply voltage give rise to an undefined main stage spool position.



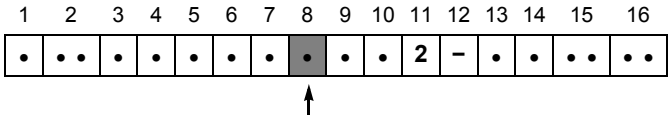
Digit 7
Hydraulic control type,
Pilot pressure port X and leakage port Y

The 7th digit in the valve type designation provides information about whether pilot pressure port X and leakage port Y are internally or externally connected in the valve.

Variant	Intake X	Drain Y
4	internally connected	internally connected
5	externally connected	internally connected
6	externally connected	externally connected
7	internally connected	externally connected

Tab. 32: Variant of pilot pressure and leakage port in the type designation

For selection limitations, see the hydraulic symbols.
"Valve configurations and hydraulic symbols" (series-specific)
a Chap. "11 Technical Data", page 162 (table)

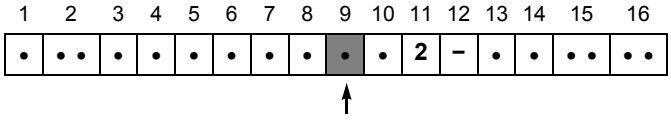


Digit 8
Seal material

The 8th digit in the type designation of the valve designates the sealing material used.

N	NBR	D941K to D944K
V	FKM	D941K to D945K
S	Edge seal HNBR	D945K
X		Special versions on request

Tab. 33: Seal material variant in the type designation

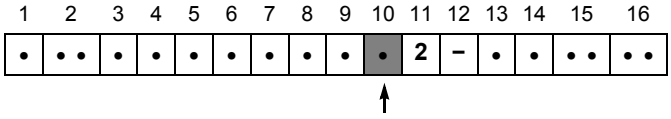


Digit 9
Valve connector X1

The 9th digit of the valve's type designation specifies the version of the valve connector X1.

J	7-pole	

Tab. 34: Variant of the valve connector X1 in the type designation



Digit 10
Command signal for 100 % spool stroke

The 10th digit of the valve's type designation provides information about which signal type is set in the valve on delivery.

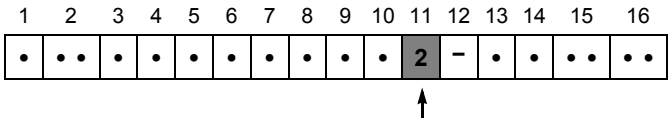
The signal type of the command signal input applies in combination with the signal type of the spool position signal (actual value output).

Variant	Command signals for 100 % spool stroke	
	Command signal (I_{in} and U_{in}) (X1, input contacts 1 and 2)	**Stroke position signal (I_{Out} and U_{Out})** (X1, output contact 4)
D	±10 V	2–10 V
E	4–20 mA	4–20 mA
M	±10 V	4–20 mA
X	±10 mA	4–20 mA
9	Fieldbus	Fieldbus
Y	Others on request.	

Tab. 35: Signal types command value and spool position signal in the type designation

The analog command signal I_{in} or U_{in} is the flow command value input.
The stroke position signal (actual output value) I_{out} or U_{out} is proportional to the mechanical position of the spool.

a Chap. "7 Electrical connection", page 68

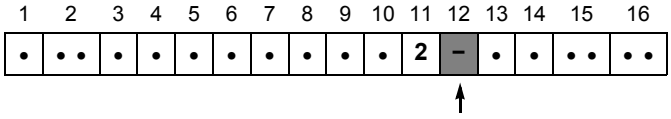


Digit 11
Supply voltage

The 11th digit of the type designation specifies the supply voltage:

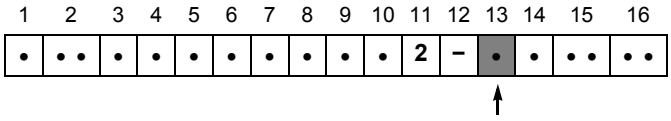
2	nominal 24 V DC

a Chap. "7 Electrical connection", page 68



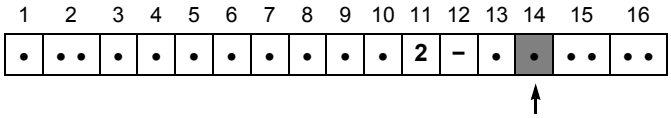
Digit 12

The 12th digit of the type designation is specified by the factory.



Digit 13

The 13th digit of the type designation of the valve provides information about the position of the spool with switched-off enable signal (X1)..

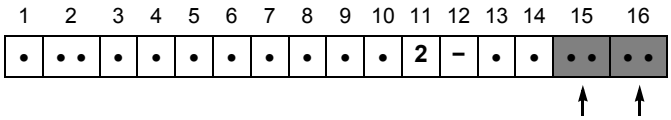


Digit 14
Fieldbus connectors X3 and X4

The 14th digit of the type designation specifies whether the valve has a fieldbus interface and which is the one in question.

Variant	Fieldbus connector
G	CAN
H	Profibus DP
J	EtherCAT
O	without fieldbus interface

Tab. 36: Variant of the fieldbus connector X3 and X4 in the type designation



Digits 15 and 16

The 15th and 16th digits of the type designation are specified by the factory.

11.1.2 LSS address

The decimal LSS address is set out in accordance with CiA DSP 305 as follows and serves to provide the CAN bus node with an internationally unique identification:

LSS address

40	/	Product code	/	Version without leading zeros	/	Serial number without country identification
↑ Manufacturer ID				a Chap. "11.1.1 Model number and type designation", page 166		⇨ a Fig. 54, page 164 item 3

Example:
40/43/1/4321

Even valves without CAN bus interfaces are assigned a decimal LSS address during manufacturing.

11.1.3 Data matrix code

Data matrix code

The data matrix code is a two-dimensional code. The code on the nameplate contains a character string that is set out as follows:

Model number	#	Optional version identification	#	Serial number with country identification
a Chap. "11.1.1 Model number and type designation", page 166		⇨ a Fig. 54, page 164 item 9		⇨ a Fig. 54, page 164 item 3

If there is no optional version identification, a blank space appears here.

Example:
D941K-215A-0001#C#D4321

11.2 Electromagnetic compatibility (EMC)

Electromagnetic compatibility (EMC)

The valves in the D941K to D945K type series satisfy the EMC protection requirements for immunity to interference as per EN 61000-6-2:2005 (evaluation criterion A) and for emitted interference as per EN 61000-6-4:2005 (CAN bus and Profibus-DP) or as per EN 61000-6-3:2005 (EtherCAT).

The following technical requirements must be in place so that the EMC protection requirements can be fulfilled:

- Use of the mating connectors recommended for the valves
  a Chap. "12 Accessories, Spare Parts, and Tools", page 232
- Adequate shielding
- Version of equipotential bonding system, protective grounding, and electrical shielding.
  a Chap. "7.12.2 Equipotential bonding and protective grounding", page 97

11.3 Technical data D941K – ISO 4401-05/NG10

The technical data apply to the two-stage proportional valves in the D941K type series

- with direct-operated pilot valve D633K

a Chap. "11.3.1 Mounting surface", page 175
a Chap. "11.3.2 Data D941K with direct-operated pilot valve D633K", page 176
a Chap. " Dimensions (installation drawing), with fail-safe F and D", page 178
a Chap. " Valve configurations and hydraulic symbols", page 179
a Chap. "11.3.2 Data D941K with direct-operated pilot valve D633K", page 176

11.3.1 Mounting surface

If the valve is mounted on the mounting surface, it projects lengthwise (x-axis) over the mounting surface.
Valve dimensions:
a Chap. " Dimensions (installation drawing), with fail-safe F and D", page 178

Technical data for the mounting surface

11.3.1.1 Mounting pattern of mounting surface

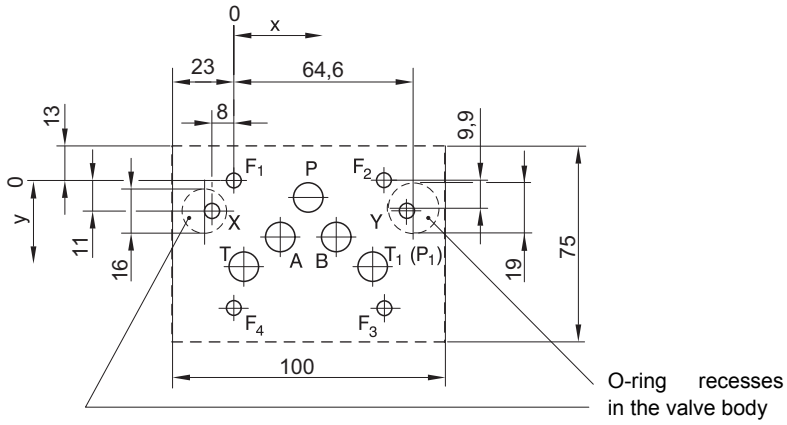
The holes in the mounting surface must correspond to ISO 4401-05-05-0-05.

Mounting length at least 100 mm.

- For the 5-way version type B80..., T_1 becomes P_1 (see hole pattern Fig. 56)
- For valves in the 4-way version and with Q_N > 60 l/min and in 2/2-way version, the second tank connection T_1 is required.

The hole pattern (Fig. 56) applies to the two-stage digital proportional valve in the D941K type series with direct-operated pilot valve D633K.

Hole pattern for the mounting surface according to ISO 4401-05-05-0-05 for D941K with direct-operated pilot valve D633K



T_1 optional

	P	A	B	T	T_1	X	Y	F_1	F_2	F_3	F_4
	Ø 11.5 (0.45)	Ø 11.5 (0.45)	Ø 11.5 (0.45)	Ø 11.5 (0.45)	Ø 11.5 (0.45)	dia. 6.3 (0.25)	dia. 6.3 (0.25)	M6	M6	M6	M6
X	27 (1.06)	16.7 (0.66)	37.3 (1.47)	3.2 (0.13)	50.8 (2.00)	-8 (-0.31)	62 (2.44)	0	54 (2.13)	54 (2.13)	0
Y	6.3 (0.25)	21.4 (0.84)	21.4 (0.84)	32.5 (1.28)	32.5 (1.28)	11 (0.43)	11 (0.43)	0	0	46 (1.81)	46 (1.81)

Fig. 56: Hole pattern in the mounting surface for the D941K type series (dimensions in mm and (in))

- For maximum flow, the ports for P, T, A, and B must contrary to the standard be designed with a diameter of 11.5 mm (0.45 in).
- F_1…F_4
  are holes for attachment screws in the holes of the mounting surface of the valve.

11.3.2 Data D941K with direct-operated pilot valve D633K

Valve design	Proportional valve, two-stage, with standard spools	**General Technical data**
Pilot valve	D633K	
Nominal size and holes	NG10, holes according to ISO 4401-05-05-0-05, with T_1 a Fig. 56, page 175	
Mounting position	In any position, fixed or movable	
Diameter of the ports and threads of the fastening holes	P, A, B, T, and T1 11.5 mm X and Y 6.3 mm F_1 to F_4 M6 a Fig. 56, page 175	
Mass	approx. 13.3 kg (29.3 lb) Valves with fail-safe functions H and K approx. 14.5 kg (32 lb)	
Dimensions	a "Dimensions (installation drawing), with fail-safe F and D", Seite 178	
Ambient temperature [1)]	for transport/storage[2)] recommended 15 °C to 25 °C permissible –40 °C to 80 °C for operation (–40 on request) –20 °C to 60 °C Depending on the certified temperature classes	**Permissible ambient conditions**
Rel. humidity for storage	< 65 % not condensing	
Vibration resistance[3)]	10 g, 3 axes, Frequency: 10 to 2,000 Hz (according to EN 60068-2-6)	
Shock resistance [3]	50 g, 6 directions, half-sine 3 ms (as per EN 60068-2-27)	
Valve configurations	5-way, 4-way, 3-way, 2/2-way and 2-way operation a Chap. "3.3.2 Valve configurations and hydraulic symbols", page 38	**Hydraulic data**
Operating pressure [4)] **of the pilot valve**	via T or Y p_T or p_y +10 bar Operating pressure range X port 10 to 350 bar max. pressure Y port [5)] 70 bar	
Maximum operating pressure range of main stage	Ports P and B 350 bar Port A: dependent on pressure transducer max. 350 bar a Tab. 28, page 167 Port T for Y internal [5] 70 bar Port T for Y external 250 bar	
linearity of pressure control	< 0.5 % of the maximum operating pressure in port A a Chap. "11.1.1 Model number and type designation", page 166	
Maximum flow Q_{max}	180 l/min (48 gpm) a Chap. "4.1 Flow diagram (4-way operation)", page 55	
Rated flow Q_N for Δp_N = 5 bar per control land	30 / 60 / 80 / 2 x 80 l/min (8 / 16 / 21 / 2 x 21 gpm) (depending on the series variant a Chap. " Type designation", "Digit 2, rated flow Q_N", Seite 167)	
Leakage flow Main stage Q_L	1.8 l/min (0.3/0.5 gpm) (≈ zero overlap)	
Pilot flow static	Pilot valve standard 0.4 l/min (0.1 gpm) trimmed 0.4 l/min (0.1 gpm)	
Pilot flow at 100 % jump	Pilot valve standard 6.0 l/min (1.6 gpm) trimmed 6.5 l/min (1.7 gpm)	
Hydraulic fluid		
Permissible fluids	Mineral-oil-based hydraulic oil as per DIN 51524-1 1 to 3 and ISO 11158 Other fluids on request	
Permissible temperature	(–40 ° on request) –20 ° to 80 ° depending on the certified temperature classes	
Viscosity ν	recommended 15 to 45 mm²/s permissible 5 to 400 mm²/s	

Tab. 37: Technical data D941K with direct-operated pilot valve D633K (Part 1 of 2)

Purity class[6], recommended (ISO 4406)	for functional safety < 18/15/12 for life cycle (wear) <17/14/11	
Step response time for 0 to 100 % spool stroke	Pilot valve 11 ms Step response and frequency response a Seite 183	**Static and dynamic data**
Threshold	< 0.05 %	
Hysteresis	< 0.2 %	
Zero shift at ΔT = 55 K	< 1.5 %	
Manufacturing tolerance	±10 %	
Relative duty cycle	100 %	**Electrical data**
Protection type	IP66 with mounted mating connectors (according to EN 60529)	
Supply voltage	Nominal 24 V (18 to 32 V) DC based on GND, Only use SELV-/PELV power supply according to EN 60204-1 At supply voltages less than 18 V, the valve is rendered in the fail-safe state. a Chap. "3.2.3 Fail-safe events", page 30	
Max. current consumption static	0.3 A	
Max. current consumption dynamic	1.2 A	
External fuse protection for each valve	1.6 A slow-blowing fuse	
EMC protection requirements	Immunity to interference as per EN 61000-6-2:2005 (evaluation criterion A) Emitted interference as per EN 61000-6-4:2005 (CAN bus and Profibus DP) or as per EN 61000-6-3:2005 (EtherCAT) a Chap. "11.2 Electromagnetic compatibility (EMC)", page 173	
Connectors	a Chap. "7 Electrical connection", page 68 a Chap. "7.4.1 Pin assignment of connector X1", page 76	
Triggering electronics	Digital control electronics integrated into the valve	

Tab. 37: Technical data D941K with direct-operated pilot valve D633K (Part 2 of 2)

[1] The ambient temperature and the temperature of the hydraulic fluid influence the temperature of the valve electronics. In order to ensure that the electronic components integrated in the valve last as long as possible, we recommend that the hydraulic fluid be kept at as low a temperature as possible at as low an ambient temperature as possible. A reference temperature is measured in the valve electronics. Fault-free operation is guaranteed up to a reference temperature of 85 °C (185 °F). At reference temperatures over 85 °C (185°F) a warning is output via the field bus on valves with field bus interfaces. At reference temperatures over 105 °C (221°F) the valve electronics are deactivated; the valve adopts the 'DISABLED' valve status and thus the mechanical fail-safe state.
a Chap. "3.2 Safety function/fail-safe", page 27

[2] **Temperature fluctuations**>10 °C must be avoided during storage.

[3] Transportation and storage should be as **vibration- and shock-free** as possible.

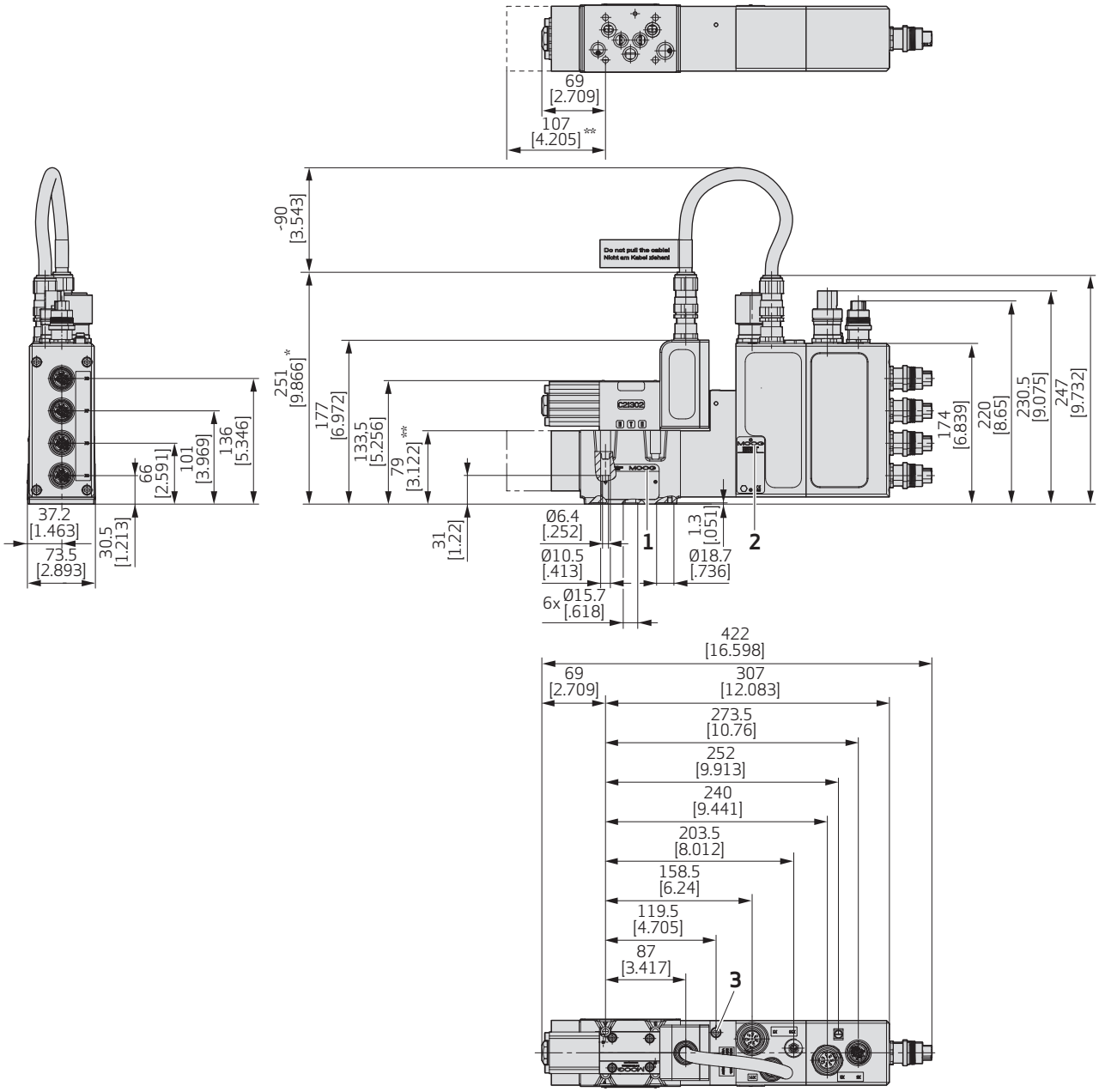
[4] **Hydraulic data** was measured with control/operating pressure p_P = 210 bar, viscosity of hydraulic fluid ν = 32 mm^2/s and temperature of hydraulic fluid T = 40 °C.
a Chap. "6 Mounting and Connection to the Hydraulic System", page 63

[5] Pressure peaks up to 210 bar permissible

[6] The **cleanliness of the hydraulic fluid** has a great effect on functional safety (reliable spool positioning, high resolution) and wear of the spool lands (pressure gain, leakage losses).

Two-stage digital proportional valve, D941K type series, with direct-operated pilot valve D633K

Dimensions (installation drawing), with fail-safe F and D



Item	Designation	Additional information
1	Nameplate	a Fig. 54, page 164
2	Ex nameplate	a Fig. 55, page 165
3	Venting screw	a Chap. "8.5.1 Venting", page 140

Fig. 57: Installation drawing for D941K (dimensions in mm)

Installation space for the connectors when mounted: a Fig. 23, page 74

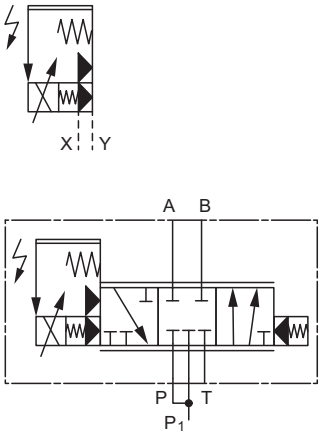
*) Dimension with fixed cabling of pilot valve with explosion-proof cable glands. If the pilot valve cabling uses explosion-proof connectors, the valve installation height increases by 50 mm (1.97 in).

**) With fail-safe D

Valve configurations and hydraulic symbols

Fail-safe function F
5-way version

X and Y optionally external or internal

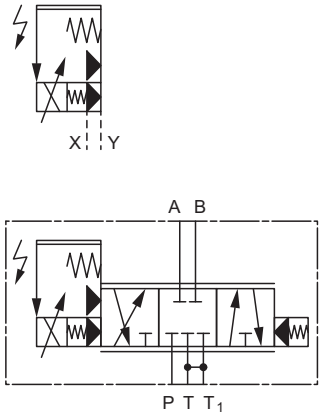


Port P_1 required
P_1 does not correspond to ISO 4401

Port P_1 is equivalent to port T_1

Fail-safe function F
4-way version

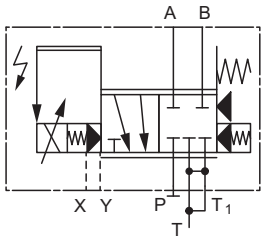
X and Y optionally external or internal



Tank port T_1 at Q_N > 60 l/min required

Fail-safe function M
2/2-way version

only X and Y external

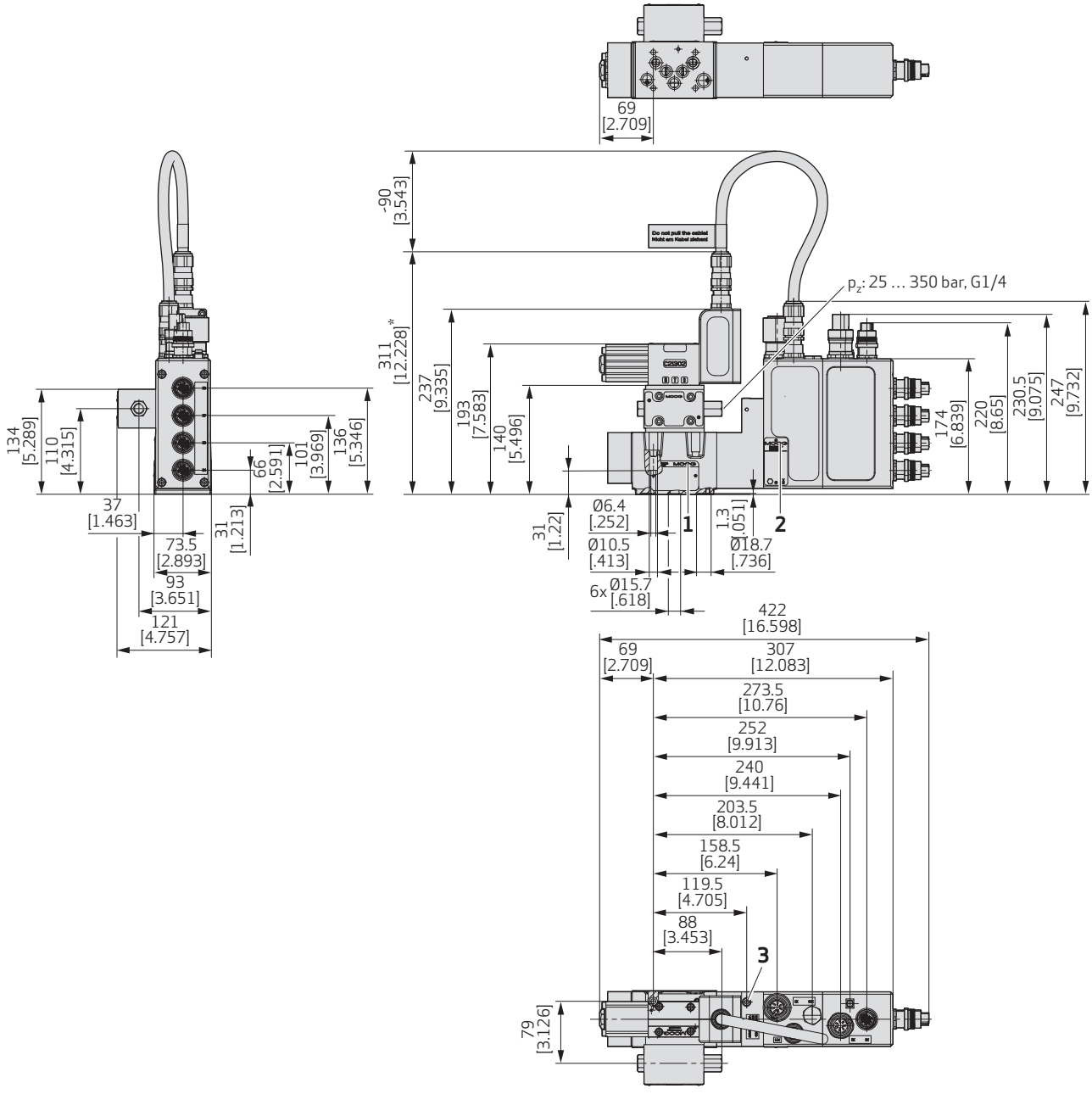


Tank port T_1 required

Execute flow direction according to symbols.

Two-stage digital proportional valve, D941K type series, with direct-operated pilot valve D633K with fail-safe function H or K for applications with safety requirements

Dimensions (installation drawing), mechanical/hydraulic fail-safe H and K



Item	Designation	Additional information
1	Nameplate	a Fig. 54, page 164
2	Ex nameplate	a Fig. 55, page 165
3	Venting screw	a Chap. "8.5.1 Venting", page 140

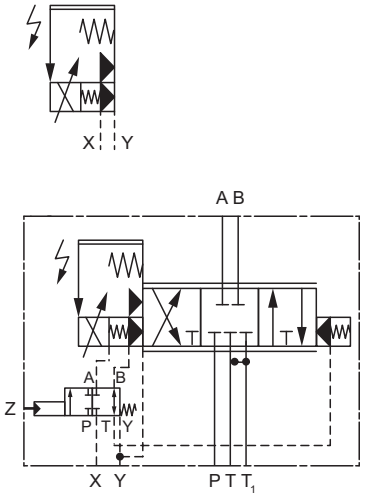
Fig. 58: Installation drawing for D941K (dimensions in mm)

Installation space for the connectors when mounted: a Fig. 23, page 74

*) Dimension with fixed cabling of pilot valve with explosion-proof cable glands. If the pilot valve cabling uses explosion-proof connectors, the valve installation height increases by 50 mm (1.97 in).

Fail-safe function H
4-way version

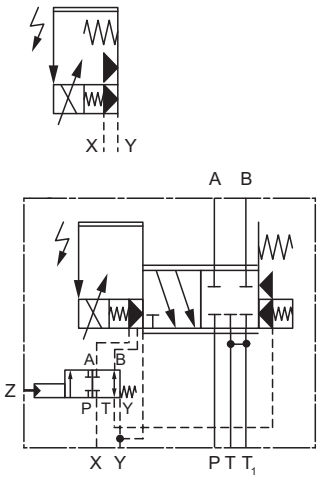
X and Y optionally external or internal



defined A→T

Fail-safe function K
2/2-way version

only X and Y external

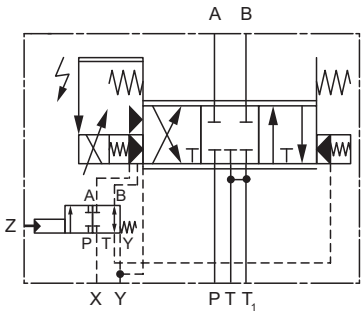


defined middle

Execute flow direction according to symbols.

Fail-safe function K
4-way version

X and Y optionally external or internal



defined middle

Characteristic curves, D941K valves with direct-operated pilot valve D633K

- All characteristic curves in the section "Characteristic curves, D941K valves with pilot valve D633K" are typical characteristic curves for the D941K valve with pilot valve D633K with control/operating pressure p_P = 210 bar, viscosity of hydraulic fluid ν = 32 mm^2/s and temperature of hydraulic fluid T = 40 °C.
- For Q_N > 60 l/min, a second tank port T_1 is required.

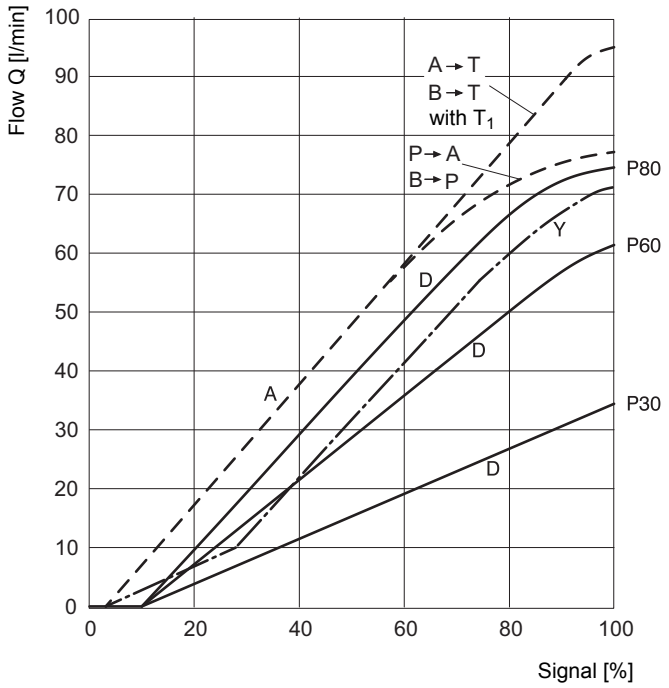
Flow diagram (4-way operation)

a Chap. "4.1 Flow diagram (4-way operation)", page 55

Flow diagram

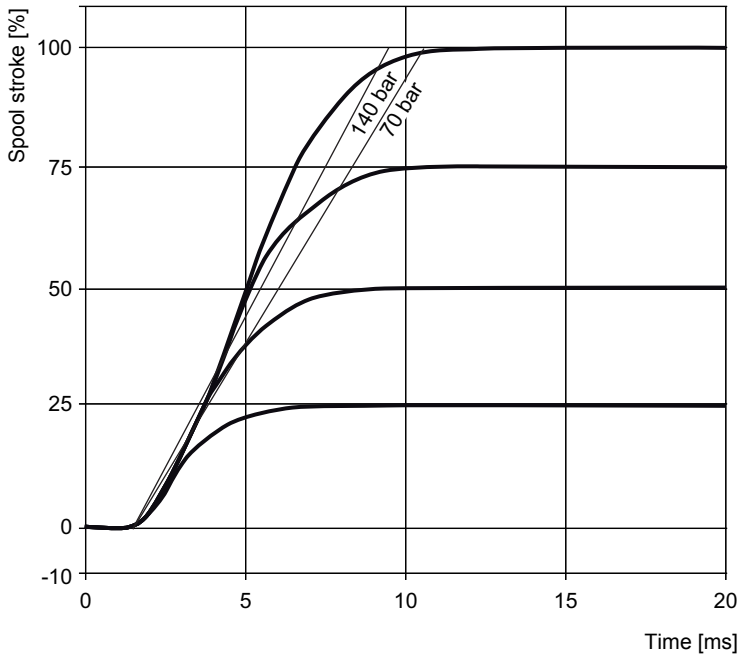
Flow signal characteristic curve at rated pressure drop Δp_N= 10 bar, that is, Δp_N = 5 bar per control land:

Flow signal characteristic curve



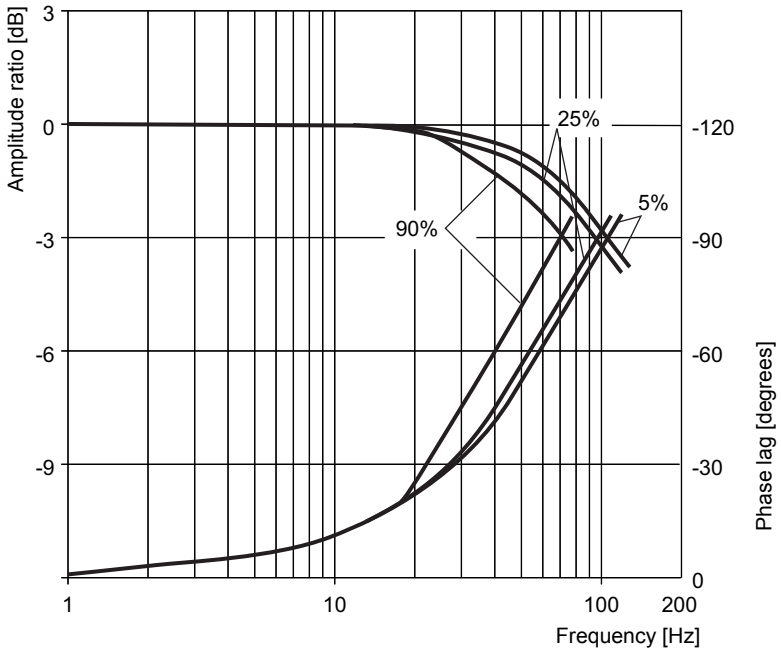
Spool **A**	≈ zero overlap, linear characteristic curve
Spool **D**	10 % positive overlap, linear characteristic curve
Spool **Y**	≈ zero overlap, dual gain flow characteristic
P30	type: standard spool rated flow 30 l/min
P60	type: standard spool rated flow 60 l/min
P80	type: standard spool rated flow 80 l/min

Fig. 59: D941K valves, flow-signal characteristics



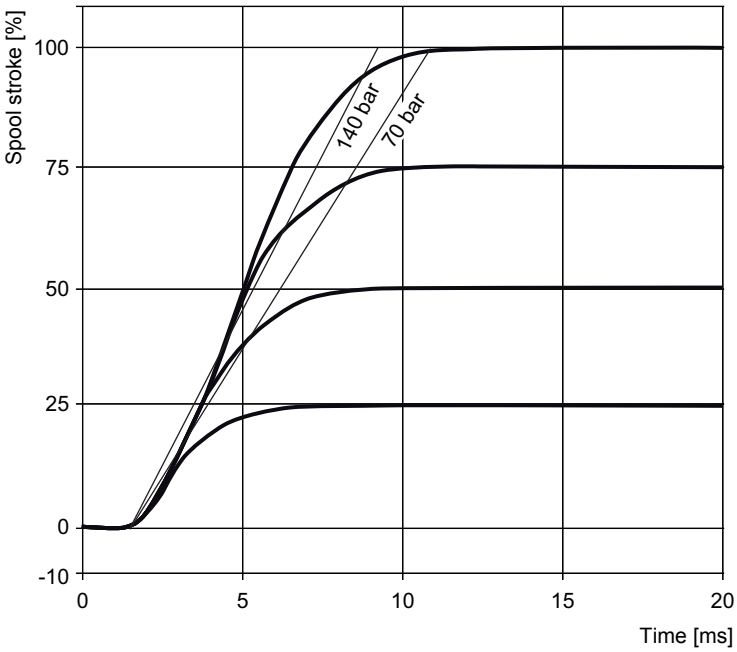
Step response for D941K valves with direct-operated pilot valve D633K, standard

Fig. 60: Step response for D941K valves, standard



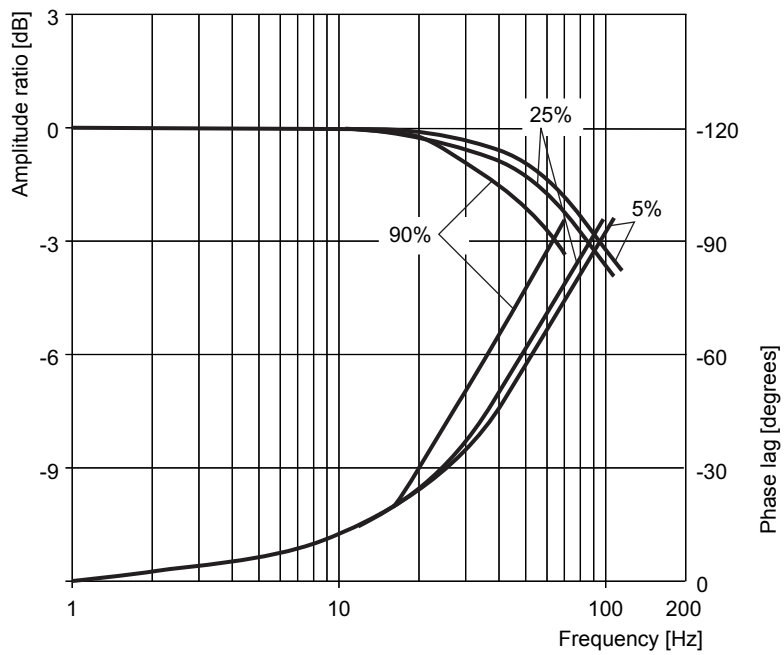
Frequency response for D941K valves with direct-operated pilot valve D633K, standard

Fig. 61: Frequency response for D941K valves, standard



Step response for D941K valves with direct-operated pilot valve D633K, trimmed

Fig. 62: Step response for D941K valves, trimmed



Frequency response for D941K valves with direct-operated pilot valve D633K, trimmed

Fig. 63: Frequency response for D941K valves, trimmed

11.4 Technical data D942K – ISO 4401-07/NG16

The technical data applies to proportional valves in the D942K type series

- two-stage, with direct-operated pilot valve D633K

a Chap. "11.4.1 Mounting surface", page 186
a Chap. "11.4.2 Data D942K with direct-operated pilot valve D633K", page 187
a Chap. " Dimensions (installation drawing), with fail-safe F and D", page 189
a Chap. " Valve configurations and hydraulic symbols", page 190
a Chap. " Characteristic curves, D942K valves with direct-operated pilot valve D633K", page 193

11.4.1 Mounting surface

If the valve is mounted on the mounting surface, it projects lengthwise (x-axis) over the mounting surface.
Valve dimensions:
a Chap. " Dimensions (installation drawing), with fail-safe F and D", page 189

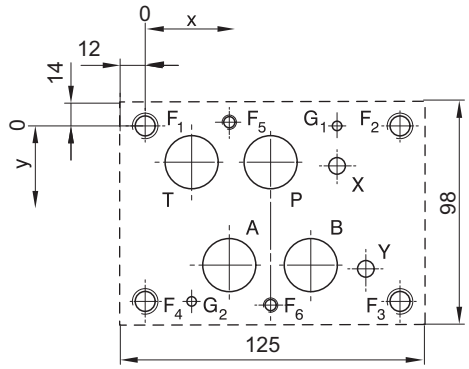
Technical data for the mounting surface

11.4.1.1 Mounting pattern of mounting surface

The holes in the mounting surface must correspond to ISO 4401-07-07-0-05.

The hole pattern (Fig. 64) applies to the digital proportional valve in the D942K type series

- two-stage, with direct-operated pilot valve D633K



Hole pattern for the mounting surface according to ISO 4401-07-07-0-05 D942K

	P	A	T	B	X	Y	G_2	G_2	F_1	F_2	F_3	F_4	F_2	F_2
	dia. 20 (0.79)	dia. 20 (0.79)	dia. 20 (0.79)	dia. 20 (0.79)	dia. 6.3 (0.25)	dia. 6.3 (0.25)	dia. 4	dia. 4	M10	M10	M10	M10	M6	M6
X	50 (1.97	34.1 (1.34)	18.3 (0.72)	65.9 (2.59)	76.6 (3.02	88.1 (3.47)	76.6 (3.02)	18.3 (0.72)	0	101.6 (4.00)	101.6 (4.00)	0	34.1 (1.34)	50 (1.97)
Y	14.3 (0.56)	55.6 (2.19)	14.3 (0.56)	55.6 (2.19)	15.9 (0.63)	57.2 (2.25)	0	69.9 (2.75)	0	0	69.9 (2.75)	69.9 (2.75)	-1.6 (-0.06)	71.5 (2.81)

Fig. 64: Hole pattern in the mounting surface for the D942K type series (dimensions in mm and (in))

- For maximum flow, the ports for P, T, A, and B must contrary to the standard be designed with a diameter of 20 mm (0.45 in).
- F_1…F_4 are holes for attachment screws in the mounting surface of the valve.
- G_1 and G_2 are holes for accommodating the transposition-proof pins of the valve.

11.4.2 Data D942K with direct-operated pilot valve D633K

Valve design	Proportional valve, two-stage, with standard spools	**General Technical data**
Pilot valve	D633K standard or trimmed	
Nominal size and holes	NG16, holes according to ISO 4401-07-07-0-05 a Fig. 64, page 186	
Mounting position	In any position, fixed or movable	
Diameter of the ports and threads of the fastening holes	P, A, T, and B 20 mm X and Y 6.3 mm F_1 to F_4 M10 F_1 to F_4 M10 G_1 and G_2 4 mm a Fig. 64, page 186	
Mass	approx. 18.5 kg (5.5 lb) Valves with fail-safe functions H and K approx. 20 kg (44 lb)	
Dimensions	a "Dimensions (installation drawing), with fail-safe F and D", Seite 189	
Ambient temperature [1]	for transport/storage[2] recommended 15 °C to 25 °C permissible –40 °C to 80 °C for operation (–40 °C on request) –20 °C to 60 °C depending on the certified temperature classes	**Permissible ambient conditions**
Rel. humidity for storage	< 65 % not condensing	
Vibration resistance[3]	10 g, 3 axes, Frequency: 10 to 2,000 Hz (according to EN 60068-2-6)	
Shock resistance [3]	50 g, 6 directions, half-sine 3 ms (as per EN 60068-2-27)	
Valve configurations	4-way, 3-way, 2/2-way and 2-way operation a Chap. "3.3.2 Valve configurations and hydraulic symbols", page 38	**Hydraulic data**
Operating pressure [4] **of the pilot valve**	via T or Y p_T or p_y +10 bar Operating pressure range X port 10 to 350 bar max. pressure Y port [5] 70 bar	
Maximum operating pressure range of main stage	Ports P and B 350 bar Port A: dependent on pressure transducer max. 350 bar a Tab. 28, page 167 Port T for Y internal [5] 70 bar Port T for Y external 250 bar	
linearity of pressure control	< 0.5 % of the maximum operating pressure in port A a Chap. "11.1.1 Model number and type designation", page 166	
Maximum flow Q_{max}	600 l/min (158.5 gpm) a Chap. "4.1 Flow diagram (4-way operation)", page 55	
Rated flow Q_N for Δp_N = 5 bar per control land	150 / 250 l/min (40 / 66 gpm) (depending on the series variant a Chap. " Type designation", "Digit 2, rated flow Q_N", Seite 167)	
Leakage flow Main stage Q_L	2.5 l/min (0.3/0.5 gpm) (≈ zero overlap)	
Pilot flow static	Pilot valve standard 0.5 l/min (0.1 gpm) trimmed 0.5 l/min (0.1 gpm)	
Pilot flow at 100 % jump	Pilot valve standard 35 l/min (9.3 gpm) trimmed 26 l/min (6.9 gpm)	
Hydraulic fluid		
Permissible fluids	Mineral-oil-based hydraulic oil as per DIN 51524-1 1 to 3 and ISO 11158 Other fluids on request	
Permissible temperature	(–40 ° on request) –20 ° to 80 ° depending on the certified temperature classes	
Viscosity ν	recommended 15 to 45 mm²/s permissible 5 to 400 mm²/s	

Tab. 38: Technical data D942K with direct-operated pilot valve D633K (Part 1 of 2)

Purity class[5], recommended (ISO 4406)	for functional safety for life cycle (wear)		< 18/15/12 <17/14/11	
Step response time for 0 to 100 % spool stroke	Pilot valve	standard trimmed	11 ms 13 ms	**Static and dynamic data**
	Step response and frequency response a Seite 194			
Threshold	< 0.1 %			
Hysteresis	< 0.2 %			
Zero shift at ΔT = 55 K	< 1 %			
Manufacturing tolerance	±10 %			
Relative duty cycle	100 %			**Electrical data**
Protection type	IP66 with mounted mating connectors (according to EN 60529)			
Supply voltage	Nominal 24 V (18 to 32 V) DC based on GND. Only use SELV-/PELV power supply according to EN 60204-1 At supply voltages less than 18 V, the valve is rendered in the fail-safe state. a Chap. "3.2.3 Fail-safe events", page 30			
Max. current consumption static	0.3 A			
Max. current consumption dynamic	1.2 A			
External fuse protection for each valve	1.6 A slow-blowing fuse			
EMC protection requirements	Immunity to interference as per EN 61000-6-2:2005 (evaluation criterion A) Emitted interference as per EN 61000-6-4:2005 (CAN bus and Profibus DP) or as per EN 61000-6-3:2005 (EtherCAT) a Chap. "11.2 Electromagnetic compatibility (EMC)", page 173			
Connectors	a Chap. "7 Electrical connection", page 68 a Chap. "7.4.1 Pin assignment of connector X1", page 76			
Triggering electronics	Digital control electronics integrated into the valve			

Tab. 38: Technical data D942K with direct-operated pilot valve D633K (Part 2 of 2)

[1] The ambient temperature and the temperature of the hydraulic fluid influence the temperature of the valve electronics. In order to ensure that the electronic components integrated in the valve last as long as possible, we recommend that the hydraulic fluid be kept at as low a temperature as possible at as low an ambient temperature as possible. A reference temperature is measured in the valve electronics. Fault-free operation is guaranteed up to a reference temperature of 85 °C (185 °F). At reference temperatures over 85 °C (185°F) a warning is output via the field bus on valves with field bus interfaces. At reference temperatures over 105 °C (221°F) the valve electronics are deactivated; the valve adopts the 'DISABLED' valve status and thus the mechanical fail-safe state.
a Chap. "3.2 Safety function/fail-safe", page 27

[2] **Temperature fluctuations**>10 °C must be avoided during storage.

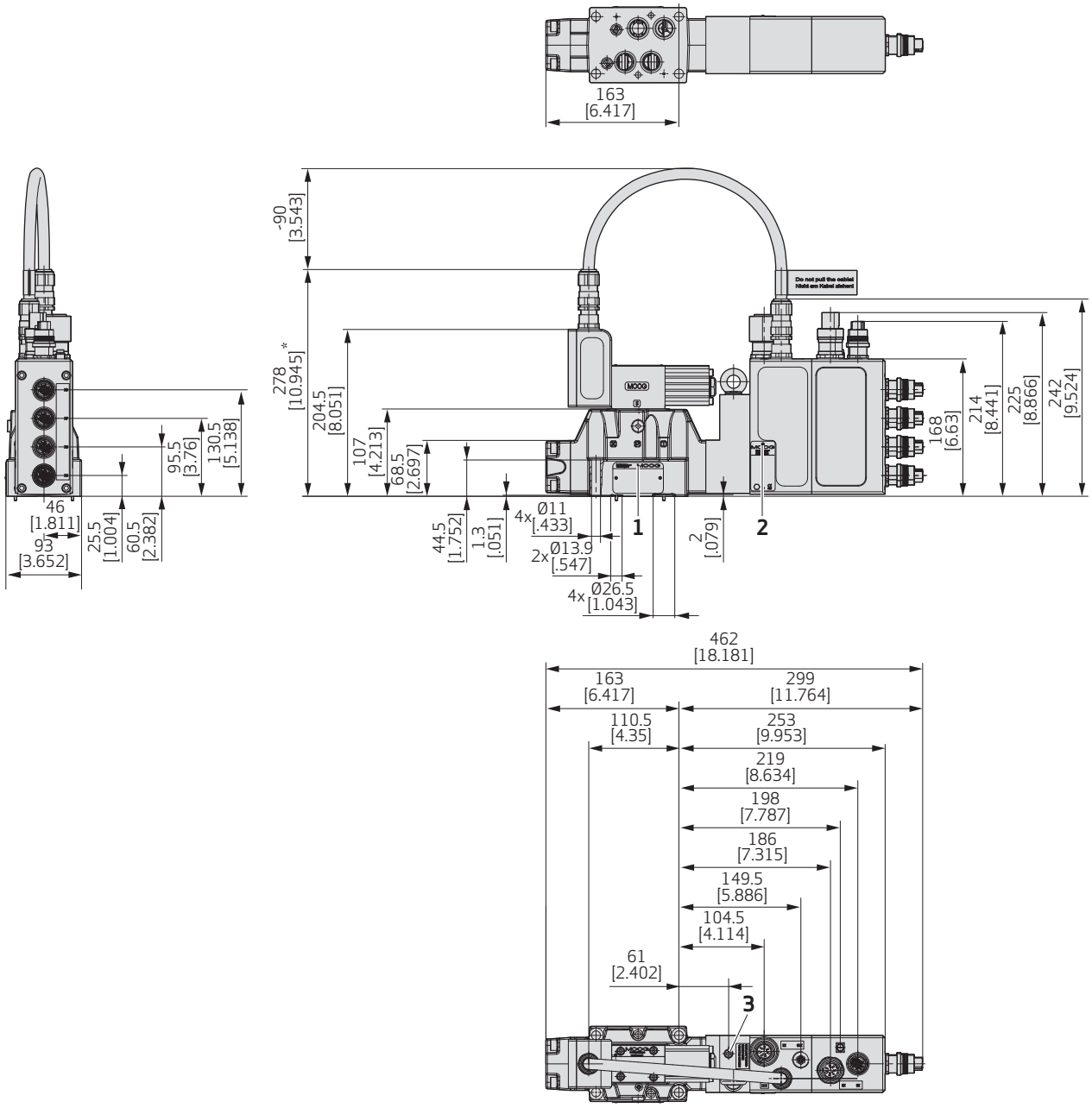
[3] Transportation and storage should be as **vibration- and shock-free** as possible.

[4] **Hydraulic data** was measured with control/operating pressure p_P = 210 bar, viscosity of hydraulic fluid ν = 32 mm^2/s and temperature of hydraulic fluid T = 40 °C.
a Chap. "6 Mounting and Connection to the Hydraulic System", page 63

[5] The **cleanliness of the hydraulic fluid** has a great effect on functional safety (reliable spool positioning, high resolution) and wear of the spool lands (pressure gain, leakage losses).

Two-stage digital proportional valve, D942K type series, with direct-operated pilot valve D633K

Dimensions (installation drawing), with fail-safe F and D



Item	Designation	Additional information
1	Nameplate	a Fig. 54, page 164
2	Ex nameplate	a Fig. 55, page 165
3	Venting screw	a Chap. "8.5.1 Venting", page 140

Fig. 65: Installation drawing for D942K (dimensions in mm)

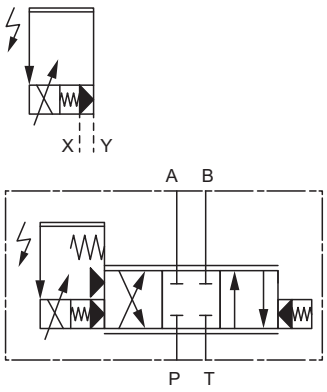
Installation space for the connectors when mounted: a Fig. 23, page 74

*) Dimension with fixed cabling of pilot valve with explosion-proof cable glands. If the pilot valve cabling uses explosion-proof connectors, the valve installation height increases by 50 mm (1.97 in).

Valve configurations and hydraulic symbols

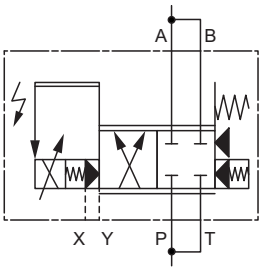
Fail-safe function F
4-way version

X and Y optionally external or internal



Fail-safe function M
2/2-way version

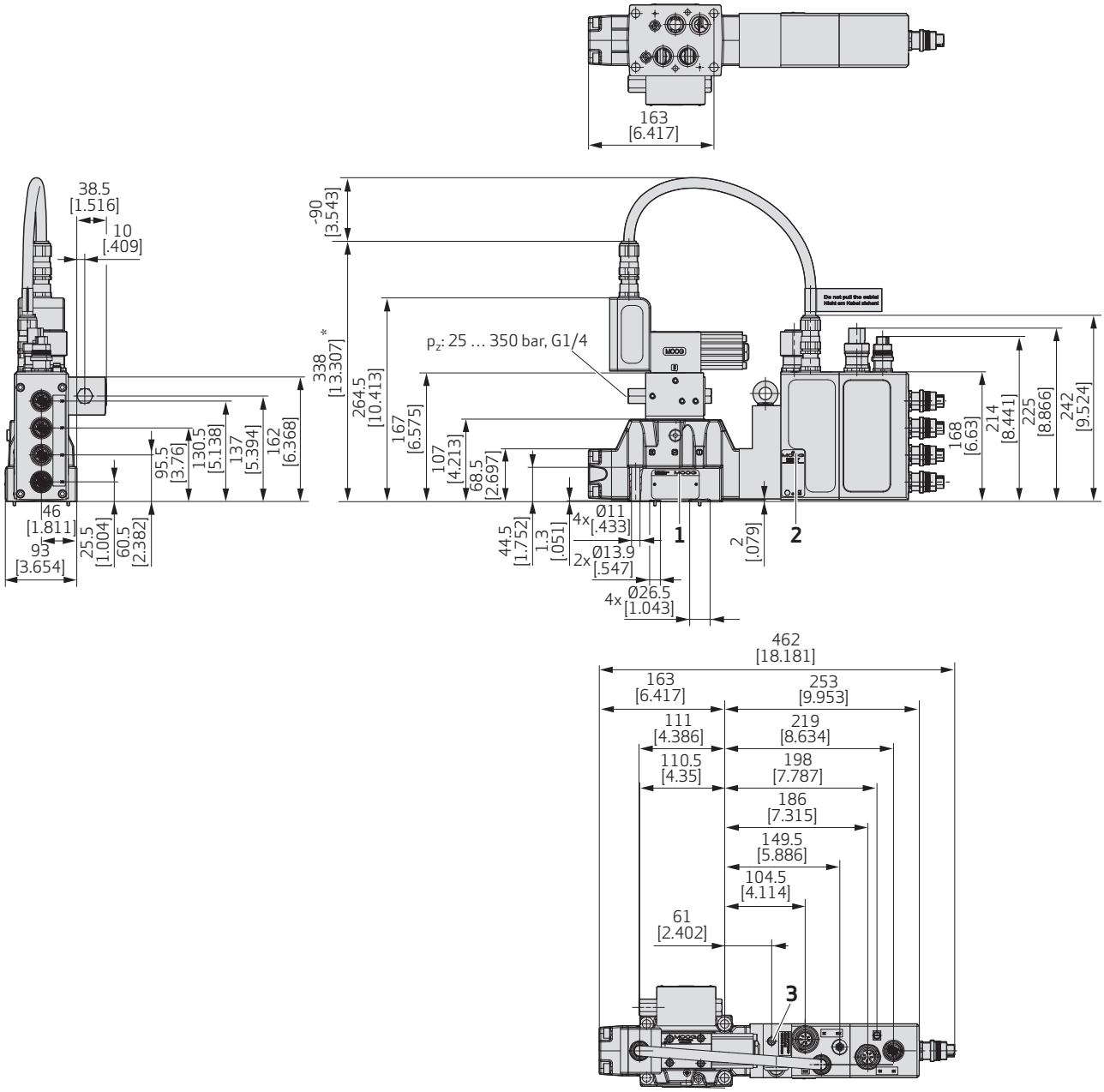
only X and Y external



Execute flow direction according to symbols.

Two-stage digital proportional valve, D942K type series, with direct-operated pilot valve D633K with fail-safe function H or K for applications with safety requirements

Dimensions (installation drawing), mechan./hydr. fail-safe H and K



Item	Designation	Additional information
1	Nameplate	a Fig. 54, page 164
2	Ex nameplate	a Fig. 55, page 165
3	Venting screw	a Chap. "8.5.1 Venting", page 140

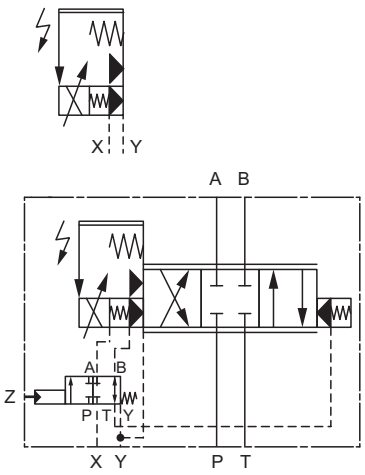
Fig. 66: Installation drawing for D942K (dimensions in mm)

Installation space for the connectors when mounted: a Fig. 23, page 74

*) Dimension with fixed cabling of pilot valve with explosion-proof cable glands. If the pilot valve cabling uses explosion-proof connectors, the valve installation height increases by 50 mm (1.97 in).

Fail-safe function H
4-way version

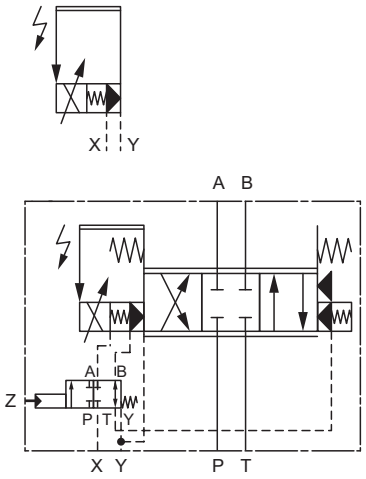
X and Y optionally external or internal



defined A→T

Fail-safe function K
4-way version

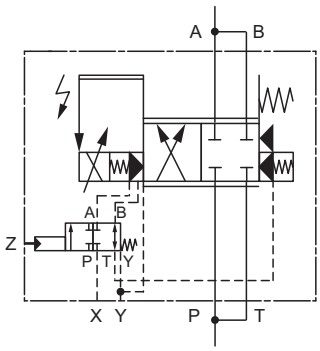
X and Y optionally external or internal



defined middle

Fail-safe function K
2/2-way version

only X and Y external



defined middle through mechanical stroke limitation

Execute flow direction according to symbols.

Characteristic curves, D942K valves with direct-operated pilot valve D633K

All characteristic curves in the section "Characteristic curves, D942K valves with pilot valve D633K" are typical characteristic curves for the D942K valve with pilot valve D633K with control/operating pressure p_P = 210 bar, viscosity of hydraulic fluid ν = 32 mm^2/s and temperature of hydraulic fluid T = 40 °C.

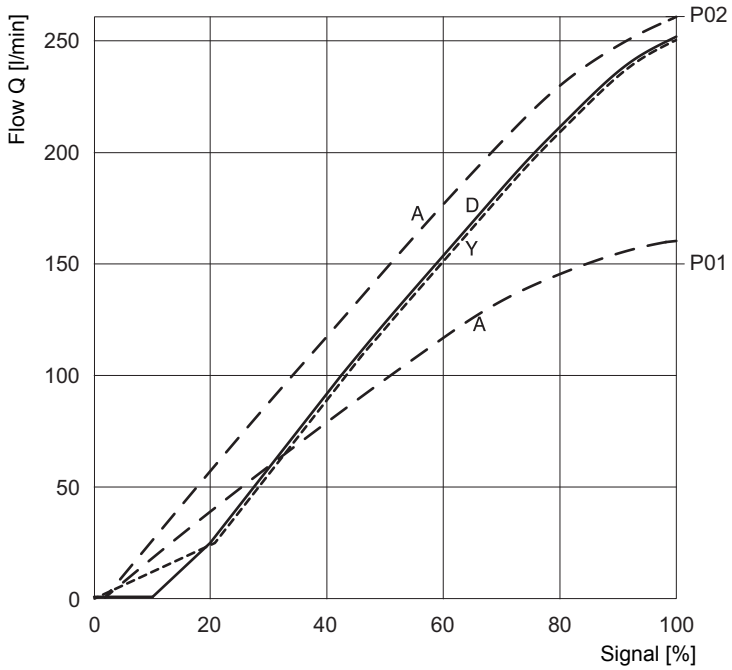
Flow diagram (4-way operation)

a Chap. "4.1 Flow diagram (4-way operation)", page 55

Flow diagram

Flow signal characteristic curve at rated pressure drop Δp_N= 10 bar, that is, Δp_N = 5 bar per control land:

Flow signal characteristic curve



Spool **A**	≈ zero overlap, linear characteristic curve
Spool **D**	10 % positive overlap, linear characteristic curve
Spool **Y**	≈ zero overlap, dual gain flow characteristic
P01	type: standard spool rated flow 150 l/min
P02	type: standard spool rated flow 250 l/min

Fig. 67: D942K valves, flow-signal characteristics

Step response for D942K valves with direct-operated pilot valve D633K, standard

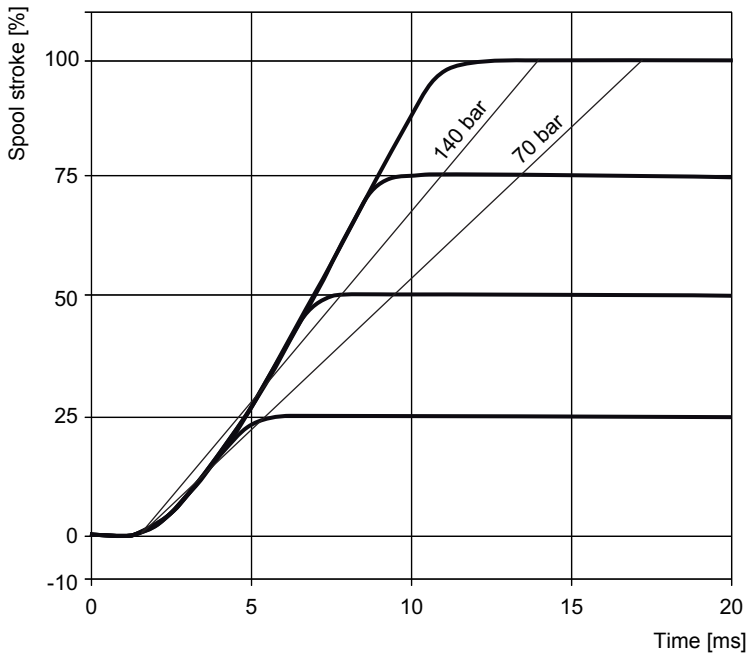


Fig. 68: Step response for D942K valves, standard

Frequency response for D942K valves with direct-operated pilot valve D633K, standard

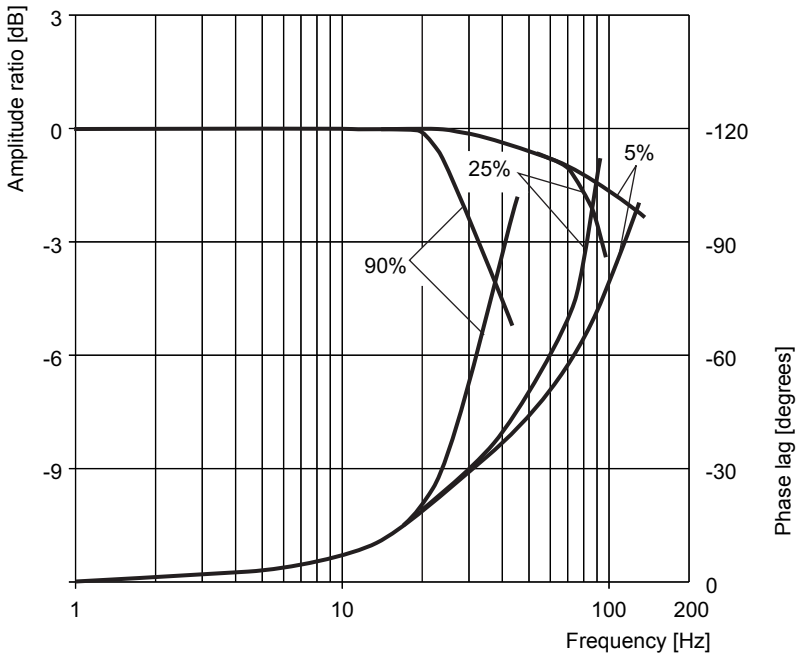


Fig. 69: Frequency response for D942K valves, standard

Step response for D942K valves with direct-operated pilot valve D633K, trimmed

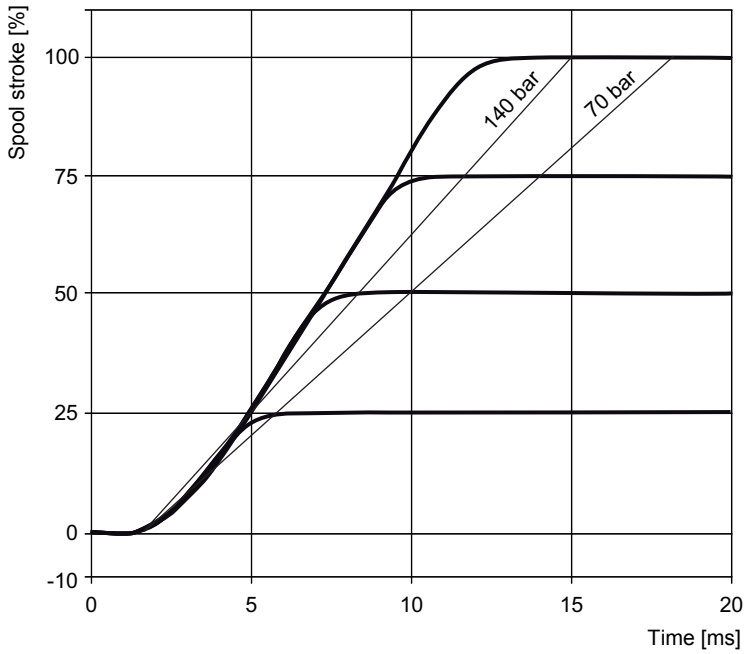


Fig. 70: Step response for D942K valves, trimmed

Frequency response for D942K valves with direct-operated pilot valve D633K, trimmed

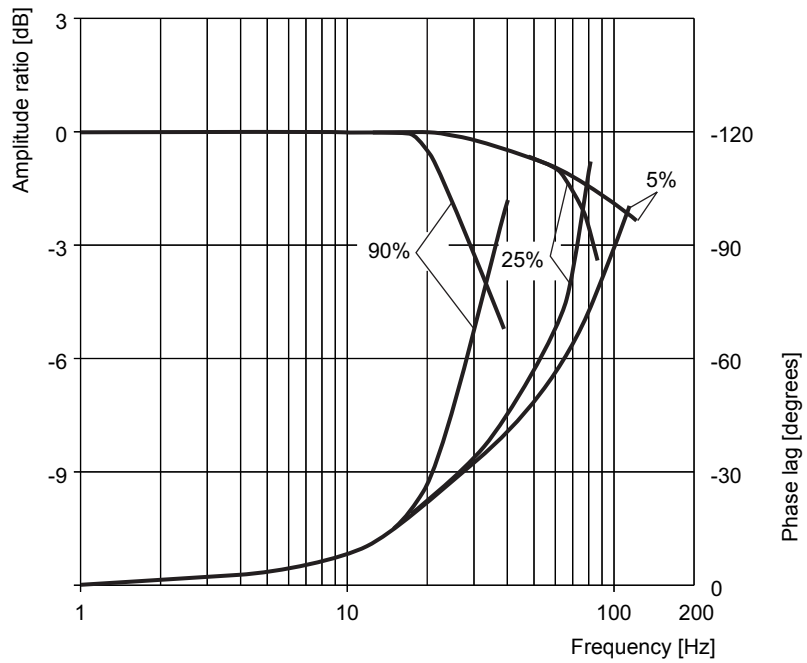


Fig. 71: Frequency response for D942K valves, trimmed

11.5 Technical data D943K – ISO 4401-08/NG25

The technical data applies to proportional valves in the D943K type series

- two-stage, with direct-operated pilot valve D633K
  a Chap. "11.5.2 Data D943K with direct-operated pilot valve D633K", page 198
  a Chap. " Technical data for the mounting surface", page 197
  a Chap. " Dimensions (installation drawing), with fail-safe F and D", page 200
  a Chap. " Valve configurations and hydraulic symbols", page 201
  a Chap. " Characteristic curves, D943K valves with direct-operated pilot valve D633K", page 204

11.5.1 Mounting surface

If the valve is mounted on the mounting surface, it projects lengthwise (x-axis) over the mounting surface.
Valve dimensions:
a Chap. " Dimensions (installation drawing), with fail-safe F and D", page 200

Technical data for the mounting surface

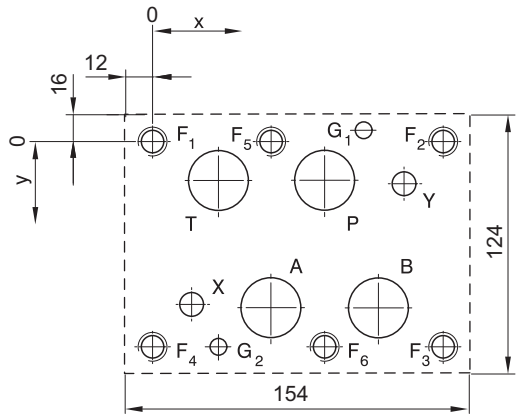
11.5.1.1 Mounting pattern of mounting surface

The holes in the mounting surface must correspond to ISO 4401-08-08-0-05.

The hole pattern (Fig. 72) applies to the digital proportional valve in the D943K type series

- two-stage, with direct-operated pilot valve D633K

Hole pattern for the mounting surface according to ISO 4401-08-08-0-05 D943K



	P	A	T	B	X	Y	G_2	G_2	F_1	F_2	F_3	F_4	F_2	F_2
	dia. 28 (1.10)	dia. 28 (1.10)	dia. 28 (1.10)	dia. 28 (1.10)	dia. 11.2 (0.44)	dia. 11.2 (0.44)	dia. 7.5 (0.30)	dia. 7.5 (0.30)	M12	M12	M12	M12	M12	M12
X	77 (3.03)	53.2 (2.09)	29.4 (1.16)	100.8 (3.97)	17.5 (0.69)	112.7 (4.44)	94.5 (3.72)	29.4 (1.16)	0	130.2 (5.13)	130.2 (5.13)	0	53.2 (2.09)	77 (3.03)
Y	17.5 (0.69)	74.6 (2.94)	17.5 (0.69)	74.6 (2.94)	73 (2.87)	19 (0.75)	-4.8 (-0.19)	92.1 (3.63)	0	0	92.1 (3.63)	92.1 (3.63)	0	92.1 (3.63)

Fig. 72: Hole pattern in the mounting surface for the D943K type series (dimensions in mm and (in))

- For maximum flow, the ports for P, T, A, and B must contrary to the standard be designed with a diameter of 28 mm (1.10 in).
- F_1…F_6 are holes for attachment screws in the mounting surface of the valve.
- G_1 and G_2 are holes for accommodating the transposition-proof pins of the valve.

11.5.2 Data D943K with direct-operated pilot valve D633K

Valve design	Proportional valve, two-stage, with standard spools	**General Technical data**
Pilot valve	D633K standard or trimmed	
Nominal size and holes	NG25, holes according to ISO 4401-08-08-0-05 a Fig. 72, page 197	
Mounting position	In any position, fixed or movable	
Diameter of the ports and threads of the fastening holes	P, A, T, B, and X 28 mm X and Y 11.2 mm F_1 to F_6 M12 G_1 and G_2 7.5 mm a Fig. 72, page 197	
Mass	approx. 26.5 kg (5.5 lb) Valves with fail-safe functions H and K approx. 28 kg (61.7 lb)	
Dimensions	a "Dimensions (installation drawing), with fail-safe F and D", Seite 200	
Ambient temperature [1)]	for transport/storage[2)] recommended 15 °C to 25 °C permissible –40 °C to 80 °C for operation (–40 °C on request) –20 °C to 60 °C depending on the certified temperature classes	**Permissible ambient conditions**
Rel. humidity for storage	< 65 % not condensing	
Vibration resistance[3)]	10 g, 3 axes, Frequency: 10 to 2,000 Hz (according to EN 60068-2-6)	
Shock protection[3]	50 g, 6 directions, half-sine 3 ms (as per EN 60068-2-27)	
Valve configurations	4-way, 3-way, 2/2-way and 2-way operation a Chap. "3.3.2 Valve configurations and hydraulic symbols", page 38	**Hydraulic data**
Operating pressure [4)] **of the pilot valve**	via T or Y p_T or p_y +10 bar Operating pressure range X port 10 to 350 bar max. pressure Y port [5] 70 bar	
Maximum operating pressure range of main stage	Ports P and B 350 bar Port A: dependent on pressure transducer max. 350 bar a Tab. 28, page 167 Port T for Y internal [5] 70 bar Port T for Y external 250 bar	
linearity of pressure control	< 0.5 % of the maximum operating pressure in port A a Chap. "11.1.1 Model number and type designation", page 166	
Maximum flow Q_{max}	1500 l/min (0.3/0.5 gpm) a Chap. "4.1 Flow diagram (4-way operation)", page 55	
Rated flow Q_N for Δp_N = 5 bar per control land	350 l/min (0.3/0.5 gpm)	
Leakage flow Main stage Q_L	3.0 l/min (0.3/0.5 gpm) (≈ zero overlap)	
Pilot flow static	Pilot valve standard 0.5 l/min trimmed 0.5 l/min	
Pilot flow at 100 % jump	Pilot valve standard 35 l/min trimmed 26 l/min	
Hydraulic fluid		
Permissible fluids	Mineral-oil-based hydraulic oil as per DIN 51524-1 1 to 3 and ISO 11158 Other fluids on request	
Permissible temperature	(–40 ° on request) –20 ° to 80 ° depending on the certified temperature classes	
Viscosity ν	recommended 15 to 45 mm²/s permissible 5 to 400 mm²/s	

Tab. 39: Technical data D943K with direct-operated pilot valve D633K (Part 1 of 2)

Purity class[5], recommended (ISO 4406)	for functional safety < 18/15/12 for life cycle (wear) < 17/14/11			
Step response time for 0 to 100 % spool stroke	Pilot valve	standard trimmed	15 ms 18 ms	**Static and dynamic data**
	Step response and frequency response a Seite 205			
Threshold	< 0.1 %			
Hysteresis	< 0.2 %			
Zero shift at ΔT = 55 K	< 1 %			
Manufacturing tolerance	±10 %			
Relative duty cycle	100 %			**Electrical data**
Protection type	IP66 with mounted mating connectors (according to EN 60529)			
Supply voltage	Nominal 24 V (18 to 32 V) DC based on GND. Only use SELV-/PELV power supply according to EN 60204-1 At supply voltages less than 18 V, the valve is rendered in the fail-safe state. a Chap. "3.2.3 Fail-safe events", page 30			
Max. current consumption static	0.3 A			
Max. current consumption dynamic	1.2 A			
External fuse protection for each valve	1.6 A slow-blowing fuse			
EMC protection requirements	Immunity to interference as per EN 61000-6-2:2005 (evaluation criterion A) Emitted interference as per EN 61000-6-4:2005 (CAN bus and Profibus DP) or as per EN 61000-6-3:2005 (EtherCAT) a Chap. "11.2 Electromagnetic compatibility (EMC)", page 173			
Connectors	a Chap. "7 Electrical connection", page 68 a Chap. "7.4.1 Pin assignment of connector X1", page 76			
Triggering electronics	Digital control electronics integrated into the valve			

Tab. 39: Technical data D943K with direct-operated pilot valve D633K (Part 2 of 2)

[1] The ambient temperature and the temperature of the hydraulic fluid influence the temperature of the valve electronics. In order to ensure that the electronic components integrated in the valve last as long as possible, we recommend that the hydraulic fluid be kept at as low a temperature as possible at as low an ambient temperature as possible. A reference temperature is measured in the valve electronics. Fault-free operation is guaranteed up to a reference temperature of 85 °C (185 °F). At reference temperatures over 85 °C (185°F) a warning is output via the field bus on valves with field bus interfaces. At reference temperatures over 105 °C (221°F) the valve electronics are deactivated; the valve adopts the 'DISABLED' valve status and thus the mechanical fail-safe state.
a Chap. "3.2 Safety function/fail-safe", page 27

[2] **Temperature fluctuations**>10 °C must be avoided during storage.

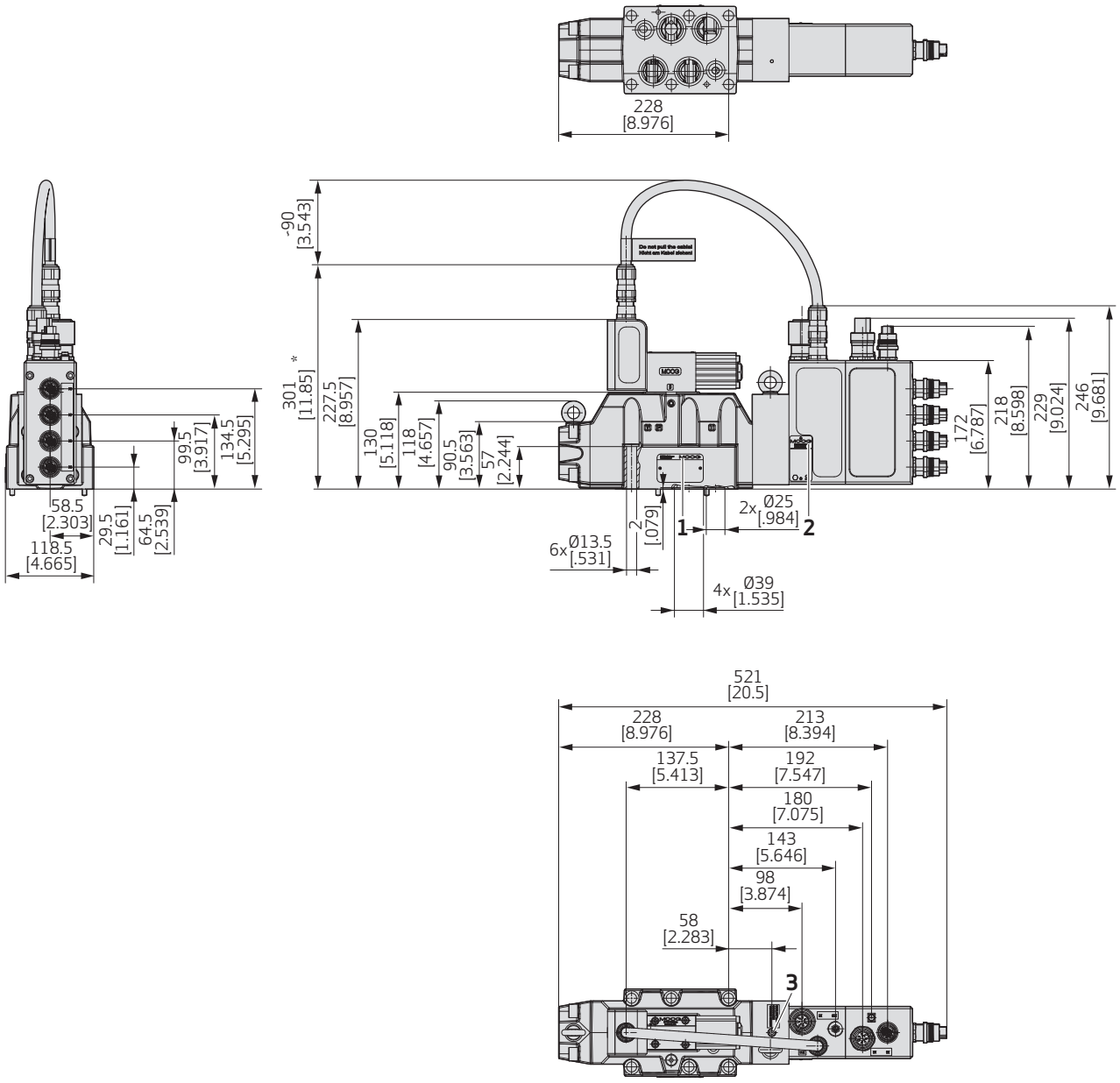
[3] Transportation and storage should be as **vibration- and shock-free** as possible.

[4] **Hydraulic data** was measured with control/operating pressure p_P = 210 bar, viscosity of hydraulic fluid ν = 32 mm^2/s and temperature of hydraulic fluid T = 40 °C.
a Chap. "6 Mounting and Connection to the Hydraulic System", page 63

[5] The **cleanliness of the hydraulic fluid** has a great effect on functional safety (reliable spool positioning, high resolution) and wear of the spool lands (pressure gain, leakage losses).

Two-stage digital proportional valve, D943K type series, with direct-operated pilot valve D633K

Dimensions (installation drawing), with fail-safe F and D



Item	Designation	Additional information
1	Nameplate	a Fig. 54, page 164
2	Ex nameplate	a Fig. 55, page 165
3	Venting screw	a Chap. "8.5.1 Venting", page 140

Fig. 73: Installation drawing for D943K (dimensions in mm)

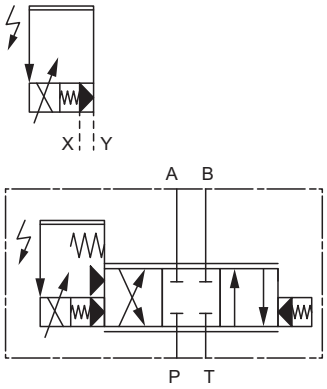
Installation space for the connectors when mounted: a Fig. 23, page 74

*) Dimension with fixed cabling of pilot valve with explosion-proof cable glands. If the pilot valve cabling uses explosion-proof connectors, the valve installation height increases by 50 mm (1.97 in).

Valve configurations and hydraulic symbols

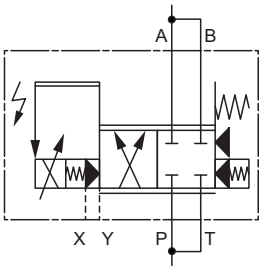
Fail-safe function F
4-way version

X and Y optionally external or internal



Fail-safe function M
2/2-way version

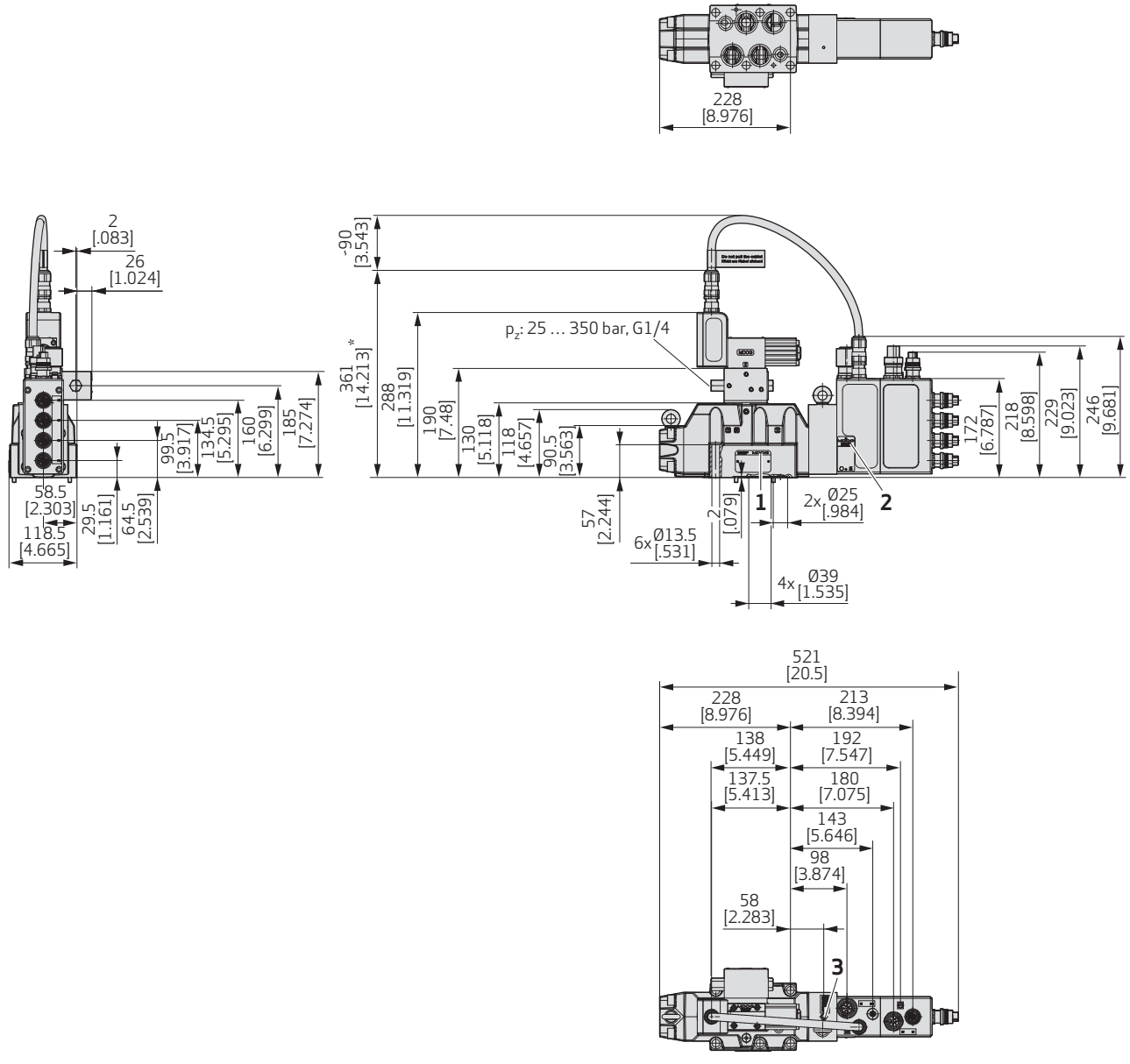
only X and Y external



Execute flow direction according to symbols.

Two-stage digital proportional valve, D943K type series, with direct-operated pilot valve D633K with fail-safe function H or K for applications with safety requirements

Dimensions (installation drawing), mechan./hydr. fail-safe H and K



Item	Designation	Additional information
1	Nameplate	a Fig. 54, page 164
2	Ex nameplate	a Fig. 55, page 165
3	Venting screw	a Chap. "8.5.1 Venting", page 140

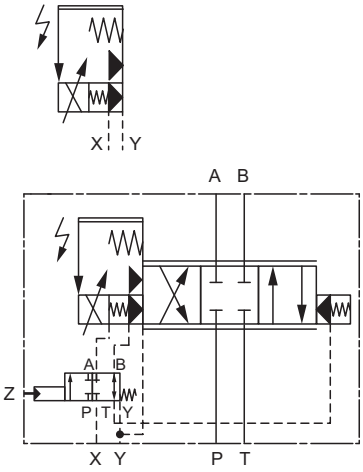
Fig. 74: Installation drawing for D943K (dimensions in mm)

Installation space for the connectors when mounted: a Fig. 23, page 74

*) Dimension with fixed cabling of pilot valve with explosion-proof cable glands. If the pilot valve cabling uses explosion-proof connectors, the valve installation height increases by 50 mm (1.97 in).

Fail-safe function H
4-way version

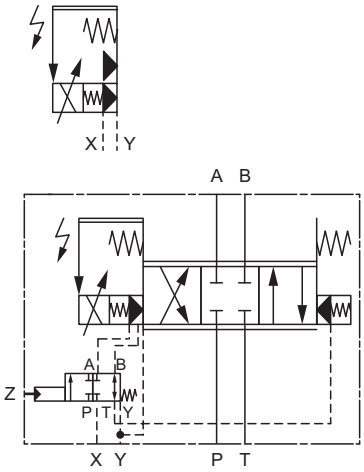
X and Y optionally external or internal



defined A→T

Fail-safe function K
4-way version

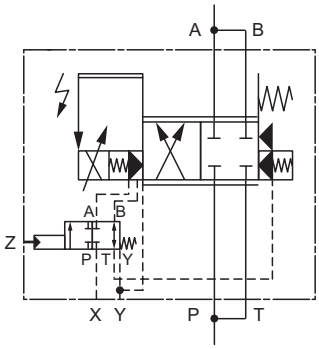
X and Y optionally external or internal



defined middle

Fail-safe function K
2/2-way version

only X and Y external



defined middle through mechanical stroke limitation

Execute flow direction according to symbols.

Characteristic curves, D943K valves with direct-operated pilot valve D633K

All characteristic curves in the section "Characteristic curves, D943K valves with pilot valve D633K" are typical characteristic curves for the D943K valve with control/operating pressure p_P = 210 bar, viscosity of hydraulic fluid ν = 32 mm^2/s and temperature of hydraulic fluid T = 40 °C (104° F).

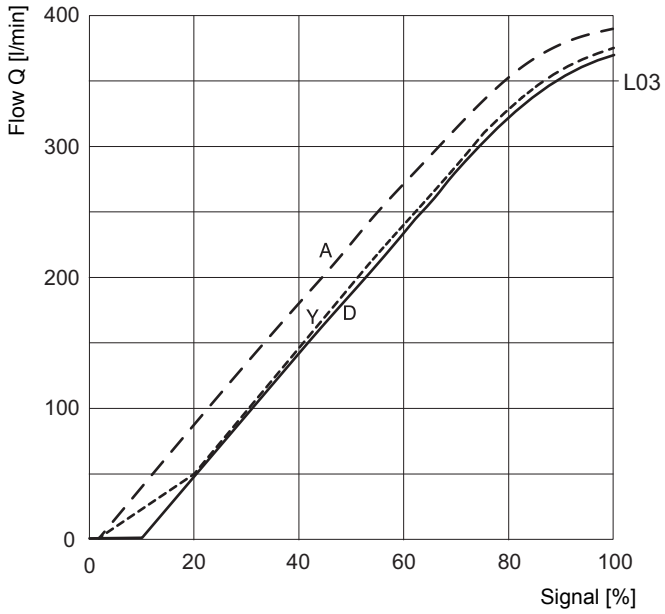
Flow diagram (4-way operation)

a Chap. "4.1 Flow diagram (4-way operation)", page 55

Flow diagram

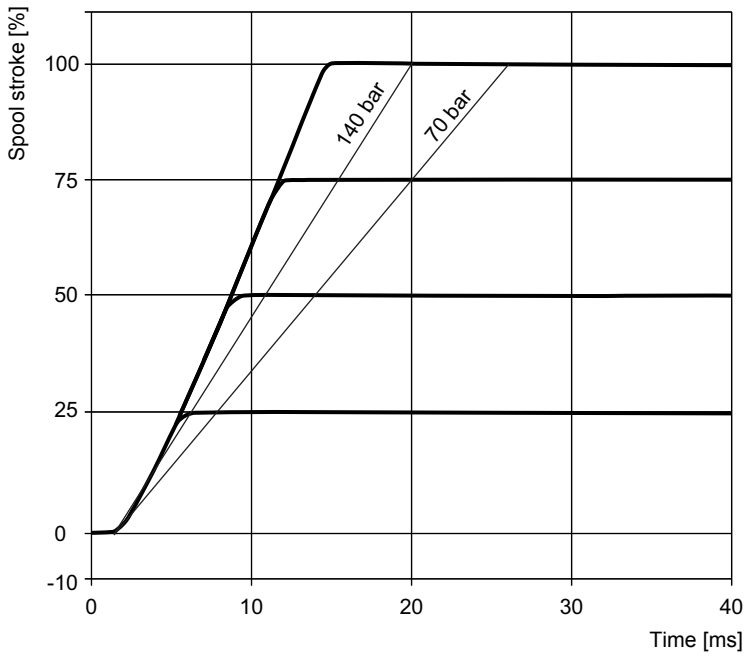
Flow signal characteristic curve at rated pressure drop Δp_N= 10 bar, that is, Δp_N = 5 bar per control land:

Flow signal characteristic curve



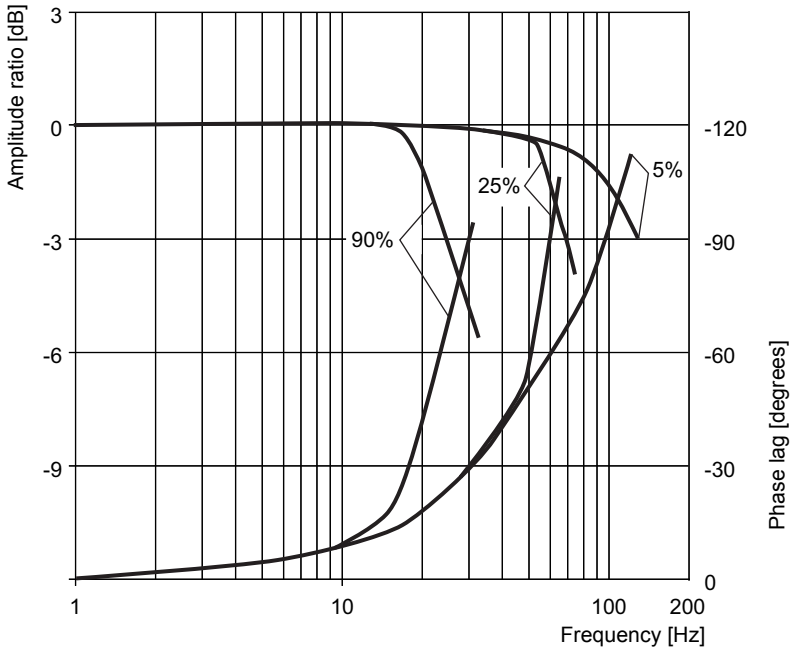
Spool **A**	≈ zero overlap, linear characteristic curve
Spool **D**	10 % positive overlap, linear characteristic curve
Spool **Y**	≈ zero overlap, dual gain flow characteristic
L03	type: stub shaft spool rated volume flow 350 l/min

Fig. 75: D943K valves, flow-signal characteristics



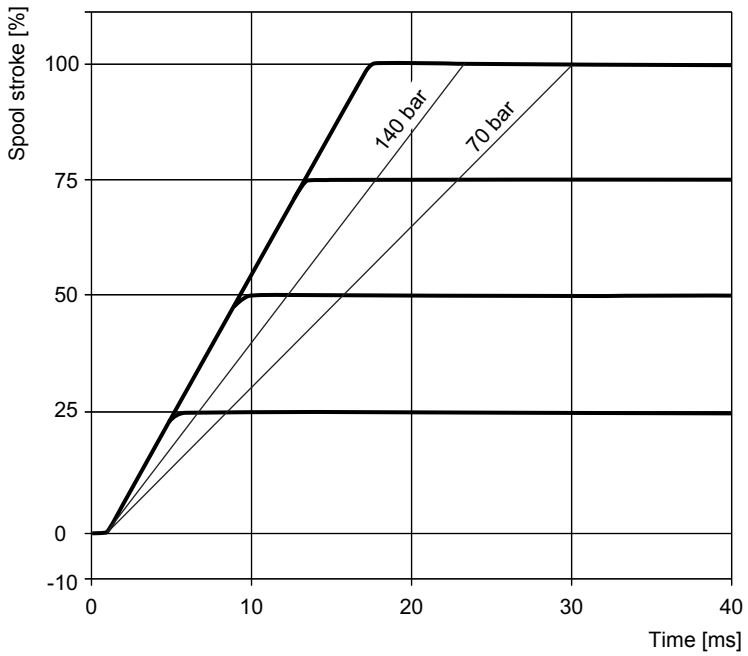
Step response for D943K valves with direct-operated pilot valve D633K, standard

Fig. 76: Step response for D943K valves, standard



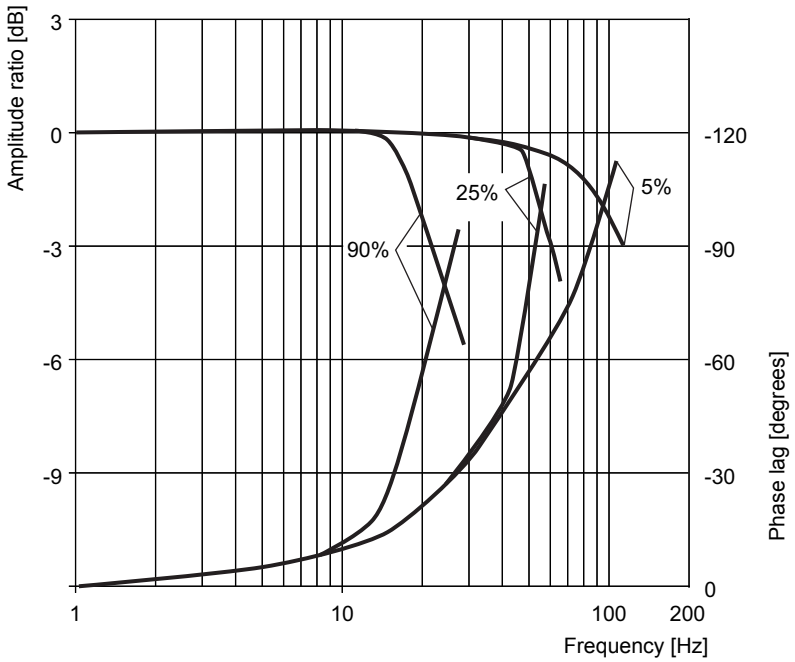
Frequency response for D943K valves with direct-operated pilot valve D633K, standard

Fig. 77: Frequency response for D943K valves, standard



Step response for D943K valves with direct-operated pilot valve D633K, trimmed

Fig. 78: Step response for D943K valves, trimmed



Frequency response for D943K valves with direct-operated pilot valve D633K, trimmed

Fig. 79: Frequency response for D943K valves, trimmed

11.6 Technical data D944K – ISO 4401-08/NG25

The technical data apply for proportional valves in the D674K series

- two-stage, with direct-operated pilot valve D633K

a Chap. "11.6.2 Data D944K with direct-operated pilot valve D633K", page 209
a Chap. "11.6.1 Mounting surface", page 208
a Chap. " Dimensions (installation drawing), with fail-safe F and D", page 211
a Chap. " Valve configurations and hydraulic symbols", page 212
a Chap. " Characteristic curves, D944K valves with direct-operated pilot valve D633K", page 215

11.6.1 Mounting surface

If the valve is mounted on the mounting surface, it projects lengthwise (x-axis) over the mounting surface.
Valve dimensions:
a Chap. " Dimensions (installation drawing), with fail-safe F and D", page 211

Technical data for the mounting surface

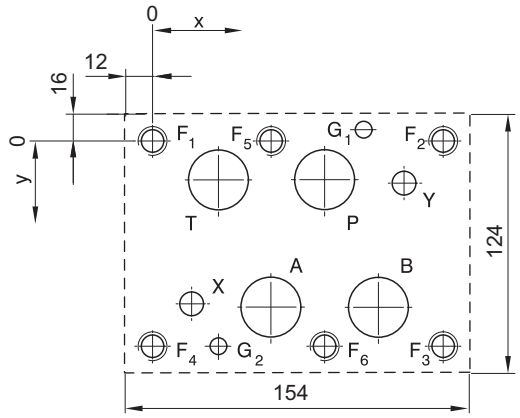
11.6.1.1 Mounting pattern of mounting surface

The holes in the mounting surface must correspond to ISO 4401-08-08-0-05.

The hole pattern (Fig. 80) applies to the digital proportional valve in the D944K type series

- two-stage, with direct-operated pilot valve D633K

Hole pattern for the mounting surface according to ISO 4401-08-08-0-05 D944K



	P	A	T	B	X	Y	G_2	G_2	F_1	F_2	F_3	F_4	F_2	F_2
	dia. 32 (1.26)	dia. 32 (1.26)	dia. 32 (1.26)	dia. 32 (1.26)	dia. 11.2 (0.44)	dia. 11.2 (0.44)	dia. 7.5 (0.30)	dia. 7.5 (0.30)	M12	M12	M12	M12	M12	M12
X	77 (3.03)	53.2 (2.09)	29.4 (1.16)	100.8 (3.97)	17.5 (0.69)	112.7 (4.44)	94.5 (3.72)	29.4 (1.16)	0	130.2 (5.13)	130.2 (5.13)	0	53.2 (2.09)	77 (3.03)
Y	17.5 (0.69)	74.6 (2.94)	17.5 (0.69)	74.6 (2.94)	73 (2.87)	19 (0.75)	-4.8 (-0.19)	92.1 (3.63)	0	0	92.1 (3.63)	92.1 (3.63)	0	92.1 (3.63)

Fig. 80: Hole pattern in the mounting surface for the D944K type series (dimensions in mm and (in))

- For maximum flow, the ports for P, T, A, and B must contrary to the standard be designed with a diameter of 32 mm (1.26 in).
- F_1…F_6 are holes for attachment screws in the mounting surface of the valve.
- G_1 and G_2 are holes for accommodating the transposition-proof pins of the valve.

11.6.2 Data D944K with direct-operated pilot valve D633K

General Technical data		
Valve design	Proportional valve, two-stage, with standard spools	
Pilot valve	D633K standard or trimmed	
Nominal size and holes	NG25, holes according to ISO 4401-08-08-0-05 a Fig. 80, page 208	
Mounting position	In any position, fixed or movable	
Diameter of the ports and threads of the fastening holes	P, A, T, B, and X 32 mm X and Y 11.2 mm F_1 to F_6 M10 G_1 and G_2 7.5 mm a Fig. 80, page 208	
Mass	approx. 26.5 kg (58.4 lb) Valves with fail-safe functions H and K approx. 28 kg	
Dimensions	a "Dimensions (installation drawing), with fail-safe F and D", Seite 211/	
Permissible ambient conditions	**Ambient temperature** [1]	for transport/storage[2] recommended 15 °C to 25 °C permissible –40 °C to 80 °C for operation (–40 on request) –20 °C to 60 °C Depending on the certified temperature classes
	Rel. humidity for storage	< 65 % not condensing
	Vibration resistance[3]	10 g, 3 axes, Frequency: 10 to 2,000 Hz (according to EN 60068-2-6)
	Shock resistance [3]	50 g, 6 directions, half-sine 3 ms (as per EN 60068-2-27)
Hydraulic data	**Valve configurations**	4-way, 3-way, 2/2-way and 2-way operation a Chap. "3.3.2 Valve configurations and hydraulic symbols", page 38
	Operating pressure [4] **of the pilot valve**	via T or Y p_T or p_y +10 bar Operating pressure range X port 10 to 350 bar max. pressure Y port [5] 70 bar
	Maximum operating pressure range of main stage	Ports P and B 350 bar Port A: dependent on pressure transducer max. 350 bar a Tab. 28, page 167 Port T for Y internal [5] 70 bar Port T for Y external 250 bar
	linearity of pressure control	< 0.5 % of the maximum operating pressure in port A a Chap. "11.1.1 Model number and type designation", page 166
	Maximum flow Q_{max}	1500 l/min (396 gpm) a Chap. "4.1 Flow diagram (4-way operation)", page 55
	Rated flow Q_N for Δp_N = 5 bar per control land	550 l/min (145 gpm)
	Leakage flow Main stage Q_L	3.0 l/min (0.79 gpm) (≈ zero overlap)
	Pilot flow static	Pilot valve standard 0.5 l/min (0.1 gpm) trimmed 0.5 l/min (0.1 gpm)
	Pilot flow at 100 % jump	Pilot valve standard 35 l/min (9.2 gpm) trimmed 26 l/min (6.9 gpm)
	Hydraulic fluid	
	Permissible fluids	Mineral-oil-based hydraulic oil as per DIN 51524-1 1 to 3 and ISO 11158 Other fluids on request
	Permissible temperature	(–40 ° on request) –20 ° to 80 ° depending on the certified temperature classes
	Viscosity ν	recommended 15 to 45 mm²/s permissible 5 to 400 mm²/s

Tab. 40: Technical data D944K with direct-operated pilot valve D633K (Part 1 of 2)

Purity class[5], recommended (ISO 4406)	for functional safety for life cycle (wear)		<18/15/12 <17/14/11	
Step response time for 0 to 100 % spool stroke	Pilot valve	standard trimmed	17 ms 23 ms	**Static and dynamic data**
	Step response and frequency response a Seite 216			
Threshold	< 0.1 %			
Hysteresis	< 0.2 %			
Zero shift at ΔT = 55 K	< 1 %			
Manufacturing tolerance	±10 %			
Relative duty cycle	100 %			**Electrical data**
Protection type	IP66 with mounted mating connectors (according to EN 60529)			
Supply voltage	Nominal 24 V (18 to 32 V) DC based on GND. Only use SELV-/PELV power supply according to EN 60204-1 At supply voltages less than 18 V, the valve is rendered in the fail-safe state. a Chap. "3.2.3 Fail-safe events", page 30			
Max. current consumption static	0.3 A			
Max. current consumption dynamic	1.2 A			
External fuse protection for each valve	1.6 A slow-blowing fuse			
EMC protection requirements	Immunity to interference as per EN 61000-6-2:2005 (evaluation criterion A) Emitted interference as per EN 61000-6-4:2005 (CAN bus and Profibus DP) or as per EN 61000-6-3:2005 (EtherCAT) a Chap. "11.2 Electromagnetic compatibility (EMC)", page 173			
Connectors	a Chap. "7 Electrical connection", page 68 a Chap. "7.4.1 Pin assignment of connector X1", page 76			
Triggering electronics	Digital control electronics integrated into the valve			

Tab. 40: Technical data D944K with direct-operated pilot valve D633K (Part 2 of 2)

[1] The ambient temperature and the temperature of the hydraulic fluid influence the temperature of the valve electronics. In order to ensure that the electronic components integrated in the valve last as long as possible, we recommend that the hydraulic fluid be kept at as low a temperature as possible at as low an ambient temperature as possible. A reference temperature is measured in the valve electronics. Fault-free operation is guaranteed up to a reference temperature of 85 °C (185 °F). At reference temperatures over 85 °C (185°F) a warning is output via the field bus on valves with field bus interfaces. At reference temperatures over 105 °C (221°F) the valve electronics are deactivated; the valve adopts the 'DISABLED' valve status and thus the mechanical fail-safe state.
a Chap. "3.2 Safety function/fail-safe", page 27

[2] **Temperature fluctuations**>10 °C must be avoided during storage.

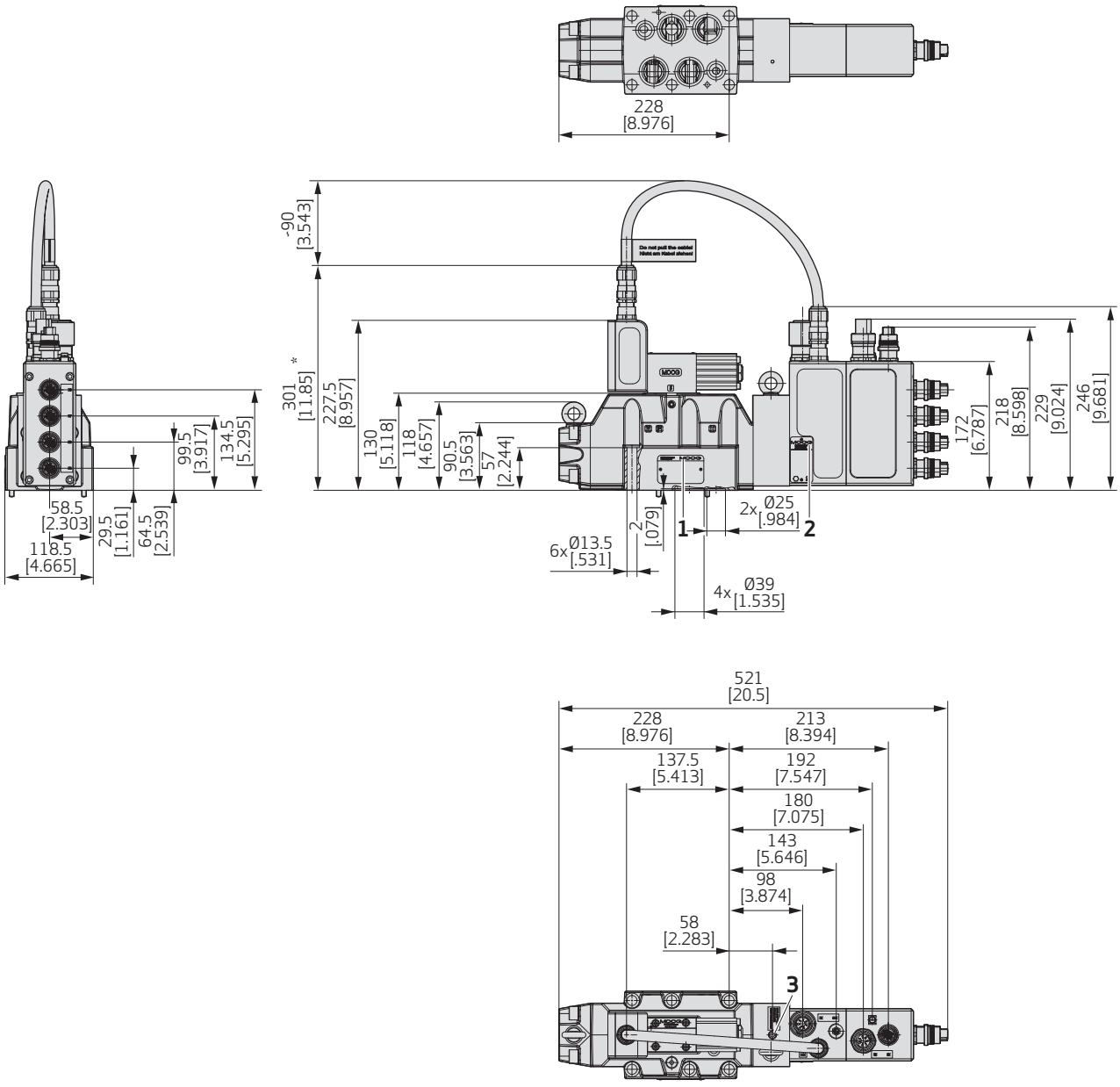
[3] Transportation and storage should be as **vibration- and shock-free** as possible.

[4] **Hydraulic data** was measured with control/operating pressure p_P = 210 bar, viscosity of hydraulic fluid ν = 32 mm^2/s and temperature of hydraulic fluid T = 40 °C (104° F).
a Chap. "6 Mounting and Connection to the Hydraulic System", page 63

[5] The **cleanliness of the hydraulic fluid** has a great effect on functional safety (reliable spool positioning, high resolution) and wear of the spool lands (pressure gain, leakage losses).

Two-stage digital proportional valve, D944K type series, with direct-operated pilot valve D633K

Dimensions (installation drawing), with fail-safe F and D



Item	Designation	Additional information
1	Nameplate	a Fig. 54, page 164
2	Ex nameplate	a Fig. 55, page 165
3	Venting screw	a Chap. "8.5.1 Venting", page 140

Fig. 81: Installation drawing for D944K (dimensions in mm)

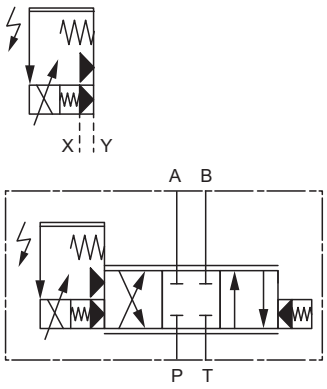
Installation space for the connectors when mounted: a Fig. 23, page 74

*) Dimension with fixed cabling of pilot valve with explosion-proof cable glands. If the pilot valve cabling uses explosion-proof connectors, the valve installation height increases by 50 mm (1.97 in).

Valve configurations and hydraulic symbols

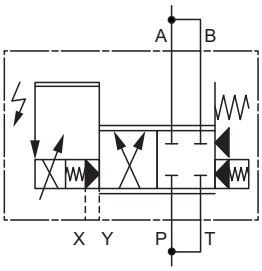
Fail-safe function F
4-way version

X and Y optionally external or internal



Fail-safe function M
2/2-way version

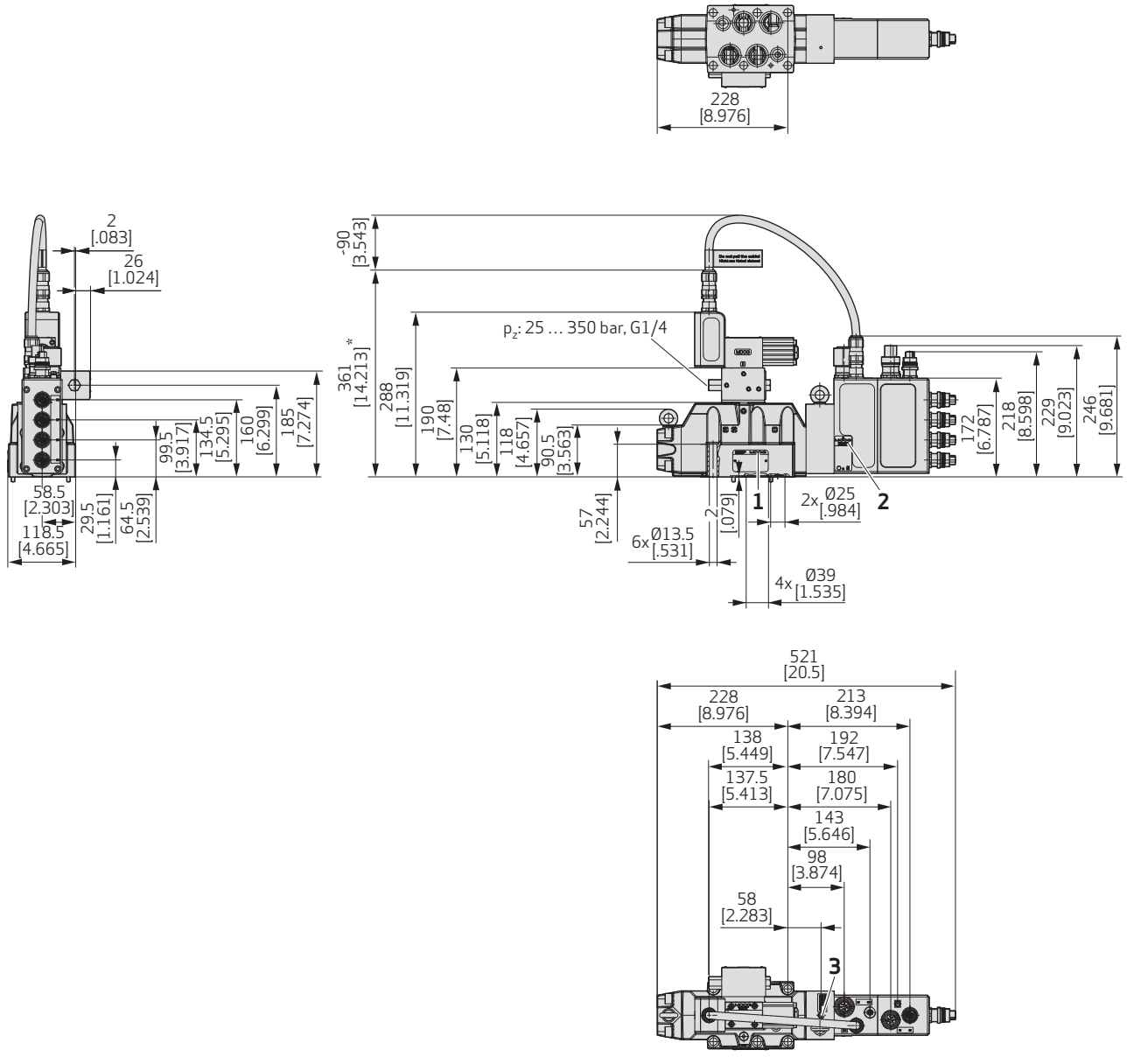
only X and Y external



Execute flow direction according to symbols.

Two-stage digital proportional valve, D944K type series, with direct-operated pilot valve D633K with fail-safe function H or K for applications with safety requirements

Dimensions (installation drawing), mechan./hydr. fail-safe H and K



Item	Designation	Additional information
1	Nameplate	a Fig. 54, page 164
2	Ex nameplate	a Fig. 55, page 165
3	Venting screw	a Chap. "8.5.1 Venting", page 140

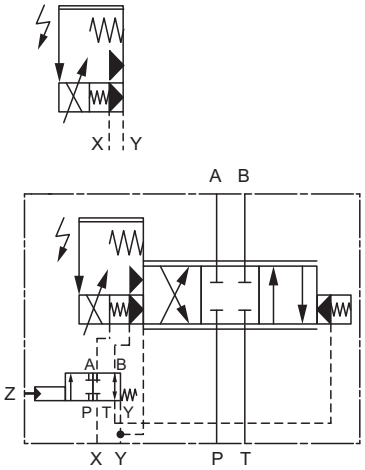
Fig. 82: Installation drawing for D944K (dimensions in mm)

Installation space for the connectors when mounted: a Fig. 23, page 74

*) Dimension with fixed cabling of pilot valve with explosion-proof cable glands. If the pilot valve cabling uses explosion-proof connectors, the valve installation height increases by 50 mm (1.97 in).

Fail-safe function H
4-way version

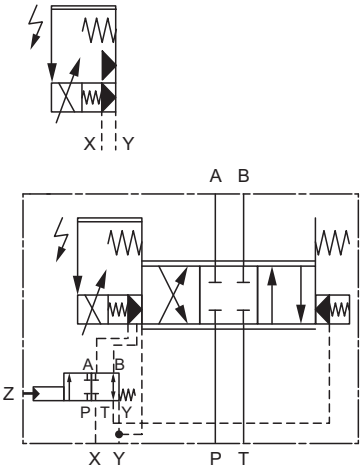
X and Y optionally external or internal



defined A→T

Fail-safe function K
4-way version

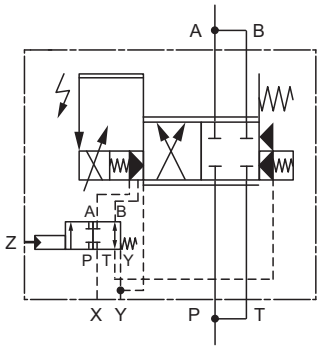
X and Y optionally external or internal



defined middle

Fail-safe function K
2/2-way version

only X and Y external



defined middle through mechanical stroke limitation

Execute flow direction according to symbols.

Characteristic curves, D944K valves with direct-operated pilot valve D633K

All characteristic curves in the section "Characteristic curves, D944K valves with pilot valve D633K" are typical characteristic curves for the D944K valve with pilot valve D633K with control/operating pressure p_P = 210 bar, viscosity of hydraulic fluid ν = 32 mm^2/s and temperature of hydraulic fluid T = 40 °C (104° F).

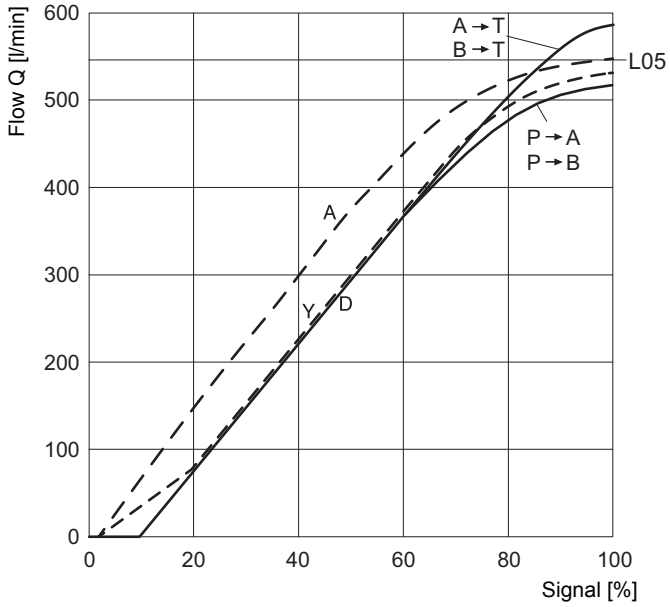
Flow diagram (4-way operation)

a Chap. "4.1 Flow diagram (4-way operation)", page 55

Flow diagram

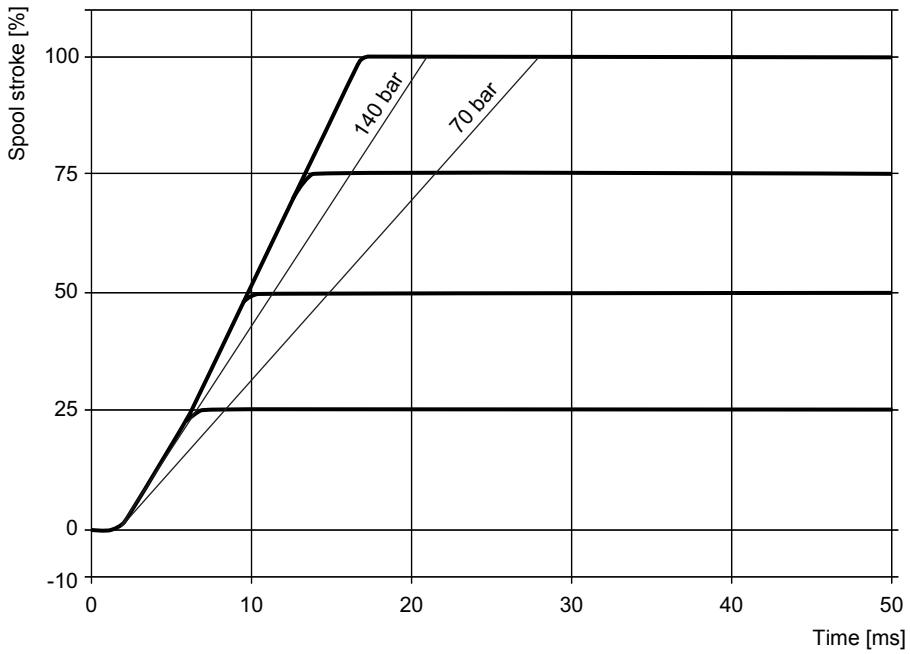
Flow signal characteristic curve at rated pressure drop Δp_N= 10 bar, that is, Δp_N = 5 bar per control land:

Flow signal characteristic curve



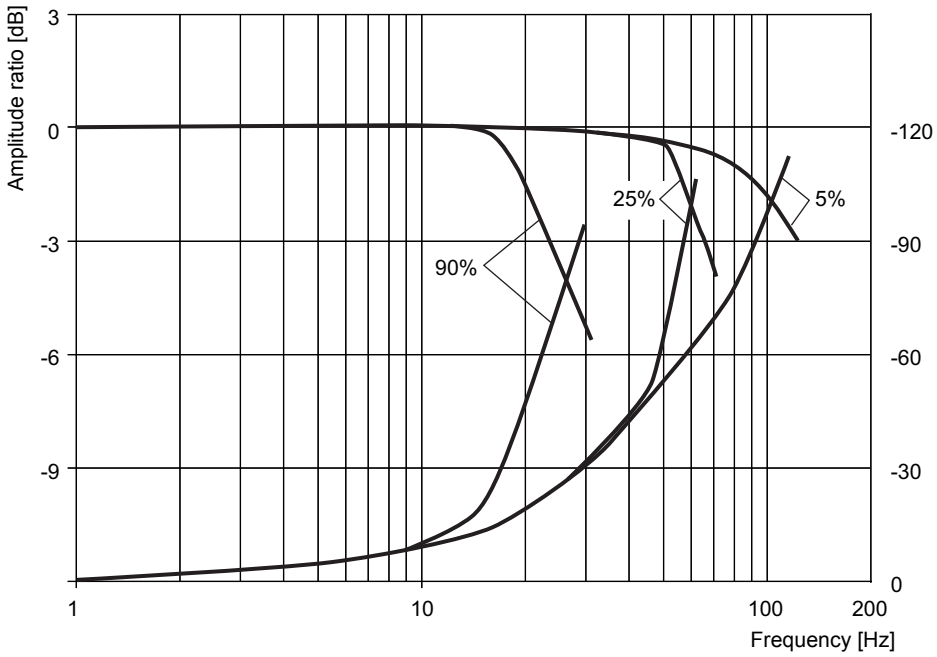
Spool **A**	≈ zero overlap, linear characteristic curve
Spool **D**	10 % positive overlap, linear characteristic curve
Spool **Y**	≈ zero overlap, dual gain flow characteristic
L05	type: stub shaft spool rated volume flow 550 l/min

Fig. 83: D944K valves, flow-signal characteristics



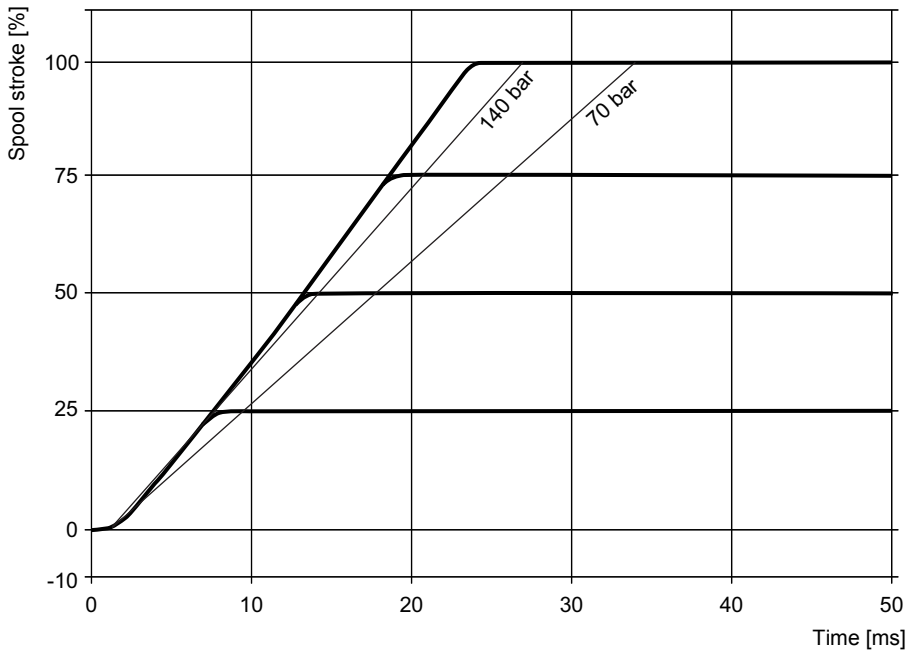
Step response for D944K valves with direct-operated pilot valve D633K, standard

Fig. 84: Step response for D944K valves, standard



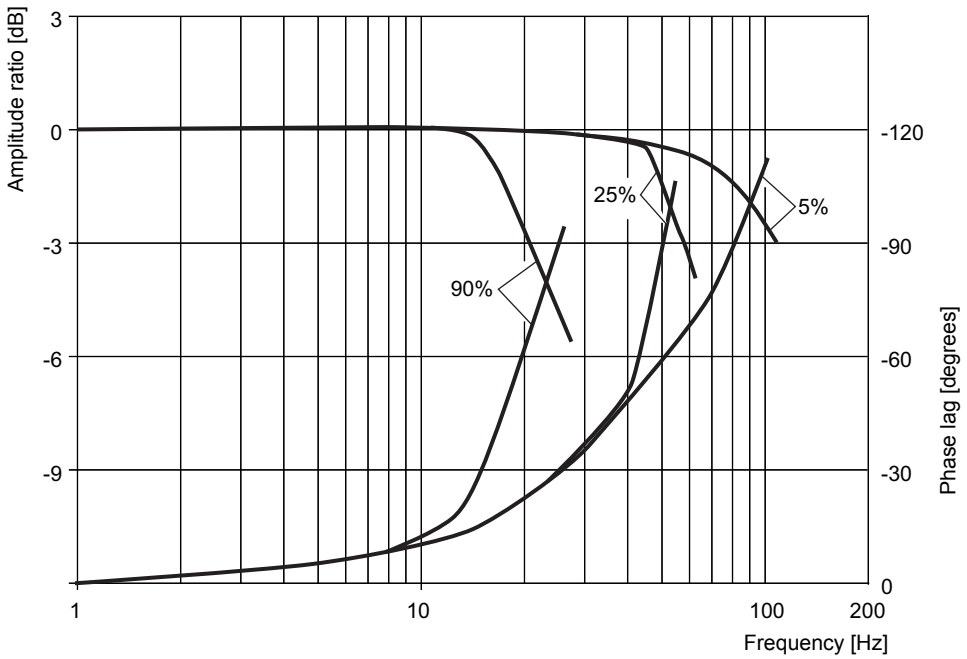
Frequency response for D944K valves with direct-operated pilot valve D633K, standard

Fig. 85: Frequency response for D944K valves, standard



Step response for D944K valves with direct-operated pilot valve D633K, trimmed

Fig. 86: Step response for D944K valves, trimmed



Frequency response for D944K valves with direct-operated pilot valve D633K, trimmed

Fig. 87: Frequency response for D944K valves, trimmed

11.7 Technical data D945K – ISO 4401-10/NG32

The technical data applies to proportional valves in the D945K type series

- two-stage, with direct-operated pilot valve D633K

a Chap. "11.7.2 Data D945K with direct-operated pilot valve D633K", page 220
a Chap. "11.7.1 Mounting surface", page 219
a Chap. " Dimensions (installation drawing), with fail-safe F and D", page 222
a Chap. " Valve configurations and hydraulic symbols", page 223
a Chap. " Characteristic curves, D945K valves with direct-operated pilot valve D633K", page 226

11.7.1 Mounting surface

Technical data for the mounting surface

If the valve is mounted on the mounting surface, it projects lengthwise (x-axis) over the mounting surface.
Valve dimensions:
a Chap. " Dimensions (installation drawing), with fail-safe F and D", page 222

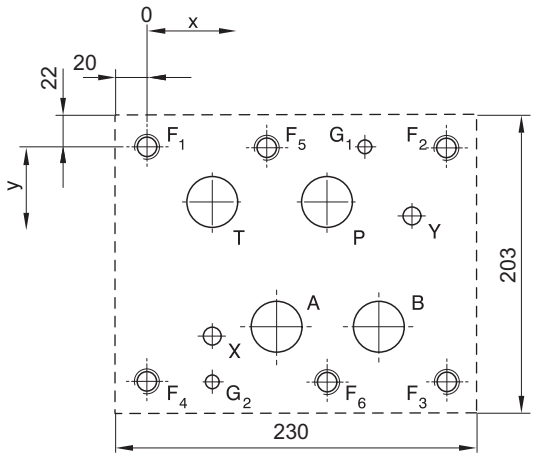
11.7.1.1 Mounting pattern of mounting surface

The holes in the mounting surface must correspond to ISO 4401-10-09-0-05.

The hole pattern (Fig. 88) applies to the digital proportional valve in the D945K type series

- two-stage, with direct-operated pilot valve D633K

Hole pattern for the mounting surface according to ISO 4401-10-09-0-05 D945K



	P	A	T	B	X	Y	G_2	G_2	F_1	F_2	F_3	F_4	F_2	F_2
	dia. 50 (1.97)	dia. 50 (1.97)	dia. 50 (1.97)	dia. 50 (1.97)	dia. 11.2 (0.44)	dia. 11.2 (0.44)	dia. 7.5 (0.30)	dia. 7.5 (0.30)	M12	M12	M12	M12	M12	M12
X	114.3 (4.50)	82.5 (3.25)	41.3 (1.63)	147.6 (5.81)	41.3 (1.63)	*168.3 (6.63)	147.6 (5.81)	41.3 (1.63)	0	190.5 (7.50)	190.5 (7.50)	0	76.2 (3.00)	114.3 (4.50)
Y	35 (1.38)	123.8 (4.87)	35 (1.38)	123.8 (4.87)	130.2 (5.13)	44.5 (1.75)	0	158.8 (6.25)	0	0	158.8 (6.25)	158.8 (6.25)	0	158.8 (6.25)

*Dimension not according to ISO but EN 24340. The position of the mounted safety pin is according to ISO is 138.6 mm (5.46 in) and it is drilled in the valve body in line with ISO.

Fig. 88: Hole pattern in the mounting surface for the D945K type series (dimensions in mm and (in))

- For maximum flow, the ports for P, T, A, and B must contrary to the standard be designed with a diameter of 50 mm (1.97 in).
- F_1…F_6 are holes for attachment screws in the mounting surface of the valve.
- G_1 and G_2 are holes for accommodating the transposition-proof pins of the valve.
- The position of the attached guard pin is according to DIN 24340.
  The hole G1 according to ISO is 138.6 mm (5.46 in) and is also drilled in the valve body.

11.7.2 Data D945K with direct-operated pilot valve D633K

Valve design	Proportional valve, two-stage, with standard spools	**General Technical data**
Pilot valve	D633K standard or trimmed	
Nominal size and holes	NG32, holes according to ISO 4401-10-09-0-05 a Fig. 88, page 219	
Mounting position	In any position, fixed or movable	
Diameter of the ports and threads of the fastening holes	P, A, T, and B 50 mm X and Y 11.2 mm F_1 to F_6 M20 G_1 and G_2 7.5 mm a Fig. 88, page 219	
Mass	approx. 76.5 kg (168.7 lb) Valves with fail-safe functions H and K approx. 78 kg	
Dimensions	a Chap. " Dimensions (installation drawing), with fail-safe F and D", page 222	
Ambient temperature [1]	for transport/storage[2] recommended 15 °C to 25 °C permissible –40 °C to 80 °C for operation (–40 on request) –20 °C to 60 °C Depending on the certified temperature classes	**Permissible ambient conditions**
Rel. humidity for storage	< 65 % not condensing	
Vibration resistance[3]	10 g, 3 axes, Frequency: 10 to 2,000 Hz (according to EN 60068-2-6)	
Shock resistance [3]	50 g, 6 directions, half-sine 3 ms (as per EN 60068-2-27)	
Valve configurations	4-way, 3-way, 2/2-way and 2-way operation a Chap. "3.3.2 Valve configurations and hydraulic symbols", page 38	**Hydraulic data**
Operating pressure [4] **of the pilot valve**	via T or Y p_T or p_y +10 bar Operating pressure range X port 10 to 350 bar max. pressure Y port [5] 50 bar	
Maximum operating pressure range of main stage	Ports P and B 350 bar Port A: dependent on pressure transducer max. 350 bar a Tab. 28, page 167 Port T for Y internal [5] 70 bar Port T for Y external 250 bar	
linearity of pressure control	< 0.5 % of the maximum operating pressure in port A a Chap. "11.1.1 Model number and type designation", page 166	
Maximum flow Q_{max}	3600 l/min (951 gpm) a Chap. "4.1 Flow diagram (4-way operation)", page 55	
Rated flow Q_N for Δp_N = 5 bar per control land	Standard and trimmed 1000 / 1500 l/min (264 /396 gpm) (depending on the series variant a Chap. " Type designation", "Digit 2, rated flow Q_N", Seite 167)	
Leakage flow Main stage Q_L	7.0 l/min (1.85 gpm) (≈ zero overlap)	
Pilot flow static	Pilot valve standard and trimmed 1.4 l/min (0.37 gpm)	
Pilot flow at 100 % jump	Pilot valve standard 35 l/min (9.25 gpm) trimmed 26 l/min (6.9 gpm)	
Hydraulic fluid		
Permissible fluids	Mineral-oil-based hydraulic oil as per DIN 51524-1 1 to 3 and ISO 11158 Other fluids on request	
Permissible temperature	(–40 ° on request) –20 ° to 80 ° depending on the certified temperature classes	
Viscosity ν	recommended 15 to 45 mm²/s permissible 5 to 400 mm²/s	

Tab. 41: Technical data D945K with direct-operated pilot valve D633K (Part 1 of 2)

Purity class[5], recommended (ISO 4406)	for functional safety <18/15/12 for life cycle (wear) <17/14/11			
Step response time for 0 to 100 % spool stroke	standard	with 1000 l/min rated flow	30 ms	**Static and dynamic data**
		with 1500 l/min rated flow	37 ms	
	trimmed	with 1000 l/min rated flow	35 ms	
		with 1500 l/min rated flow	43 ms	
	Step response and frequency response a Seite 228			
Threshold	< 0.1 %			
Hysteresis	< 0.2 %			
Zero shift at ΔT = 55 K	< 2 %			
Manufacturing tolerance	±10 %			
Relative duty cycle	100 %			**Electrical data**
Protection type	IP66 with mounted mating connectors (according to EN 60529)			
Supply voltage	Nominal 24 V (18 to 32 V) DC based on GND. Only use SELV-/PELV power supply according to EN 60204-1 At supply voltages less than 18 V, the valve is rendered in the fail-safe state. a Chap. "3.2.3 Fail-safe events", page 30			
Max. current consumption static	0.3 A			
Max. current consumption dynamic	1.2 A			
External fuse protection for each valve	1.6 A slow-blowing fuse			
EMC protection requirements	Immunity to interference as per EN 61000-6-2:2005 (evaluation criterion A) Emitted interference as per EN 61000-6-4:2005 (CAN bus and Profibus DP) or as per EN 61000-6-3:2005 (EtherCAT) a Chap. "11.2 Electromagnetic compatibility (EMC)", page 173			
Connectors	a Chap. "7 Electrical connection", page 68 a Chap. "7.4.1 Pin assignment of connector X1", page 76			
Triggering electronics	integrated into the valve			

Tab. 41: Technical data D945K with direct-operated pilot valve D633K (Part 2 of 2)

[1] The ambient temperature and the temperature of the hydraulic fluid influence the temperature of the valve electronics. In order to ensure that the electronic components integrated in the valve last as long as possible, we recommend that the hydraulic fluid be kept at as low a temperature as possible at as low an ambient temperature as possible. A reference temperature is measured in the valve electronics. Fault-free operation is guaranteed up to a reference temperature of 85 °C (185 °F). At reference temperatures over 85 °C (185°F) a warning is output via the field bus on valves with field bus interfaces. At reference temperatures over 105 °C (221°F) the valve electronics are deactivated; the valve adopts the 'DISABLED' valve status and thus the mechanical fail-safe state.
a Chap. "3.2 Safety function/fail-safe", page 27

[2] **Temperature fluctuations**>10 °C must be avoided during storage.

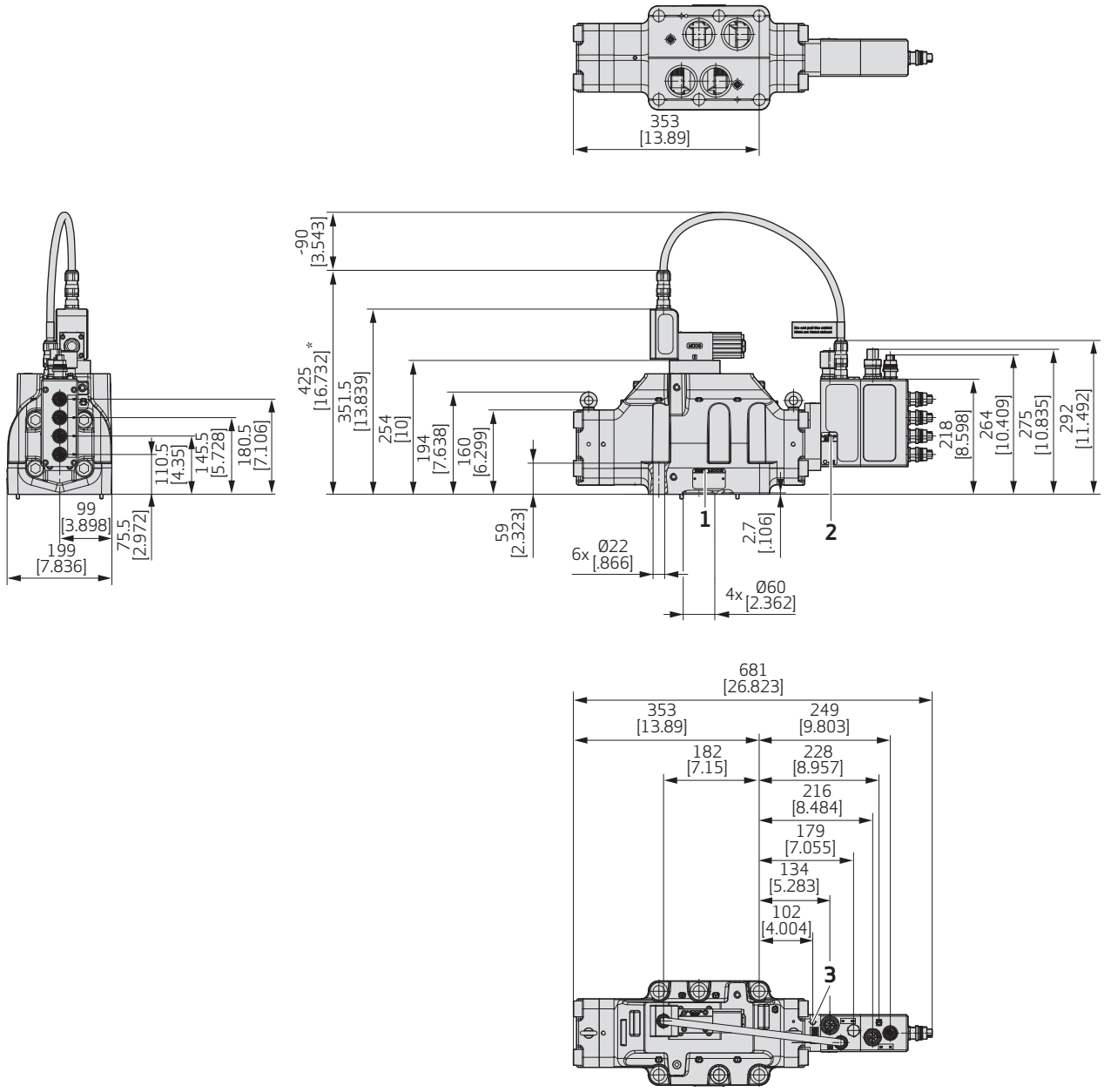
[3] Transportation and storage should be as **vibration- and shock-free** as possible.

[4] **Hydraulic data** was measured with control/operating pressure p_P = 210 bar, viscosity of hydraulic fluid ν = 32 mm^2/s and temperature of hydraulic fluid T = 40 °C (104° F).
a Chap. "6 Mounting and Connection to the Hydraulic System", page 63

[5] The **cleanliness of the hydraulic fluid** has a great effect on functional safety (reliable spool positioning, high resolution) and wear of the spool lands (pressure gain, leakage losses).

Two-stage digital proportional valve, D945K type series, with direct-operated pilot valve D633K

Dimensions (installation drawing), with fail-safe F and D



Item	Designation	Additional information
1	Nameplate	a Fig. 54, page 164
2	Ex nameplate	a Fig. 55, page 165
3	Venting screw	a Chap. "8.5.1 Venting", page 140

Fig. 89: Installation drawing for D945K (dimensions in mm)

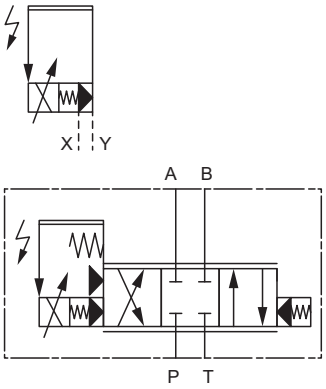
Installation space for the connectors when mounted: a Fig. 23, page 74

*) Dimension with fixed cabling of pilot valve with explosion-proof cable glands. If the pilot valve cabling uses explosion-proof connectors, the valve installation height increases by 50 mm (1.97 in).

Valve configurations and hydraulic symbols

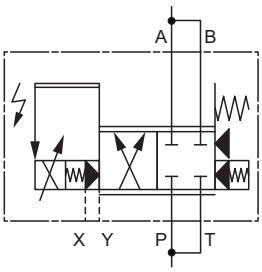
Fail-safe function F
4-way version

X and Y optionally external or internal



Fail-safe function M
2/2-way version

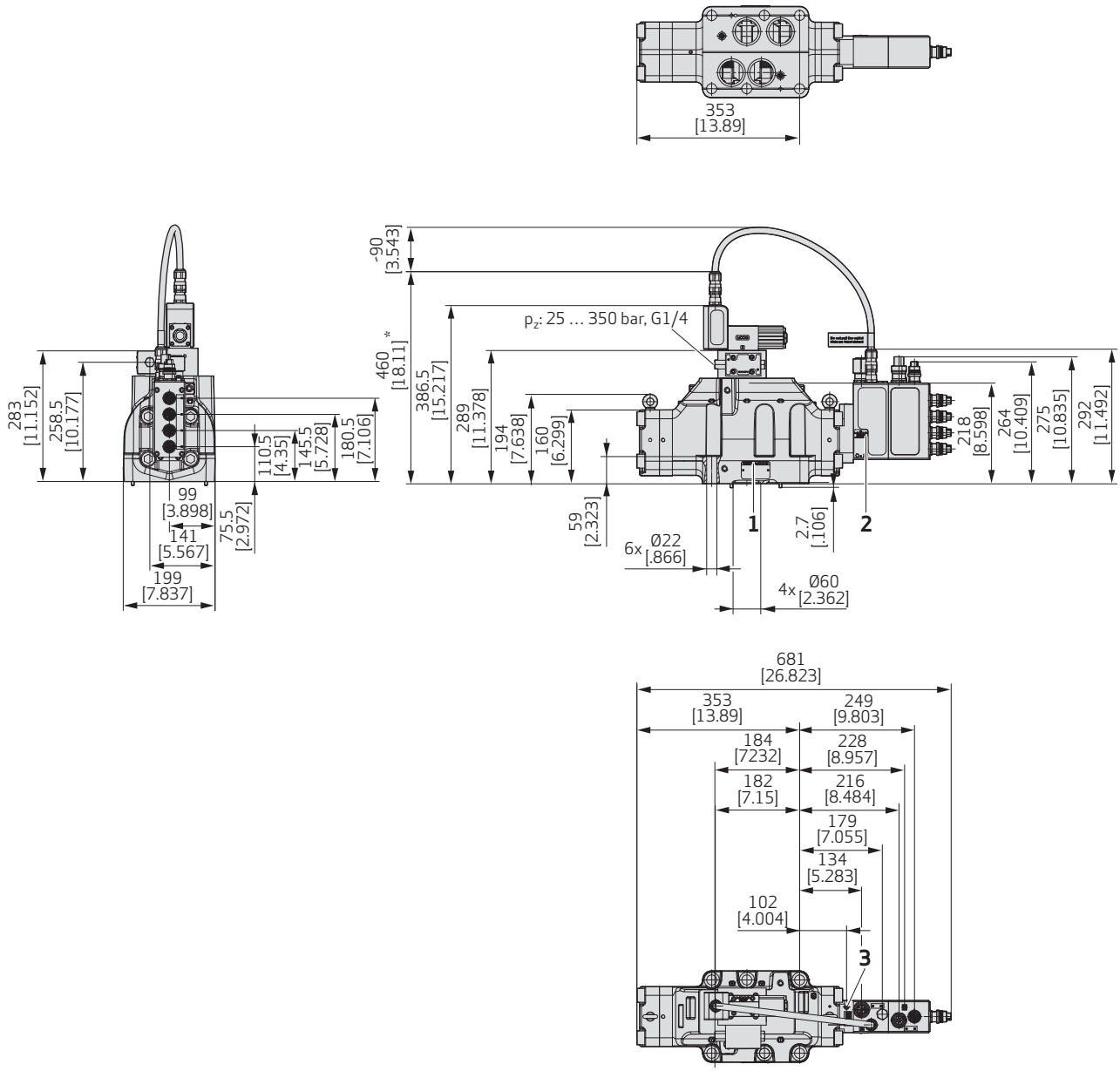
only X and Y external



Execute flow direction according to symbols.

Two-stage digital proportional valve, D945K type series, with direct-operated pilot valve D633K with fail-safe function H or K for applications with safety requirements

Dimensions (installation drawing), mechan./hydr. fail-safe H and K



Item	Designation	Additional information
1	Nameplate	a Fig. 54, page 164
2	Ex nameplate	a Fig. 55, page 165
3	Venting screw	a Chap. "8.5.1 Venting", page 140

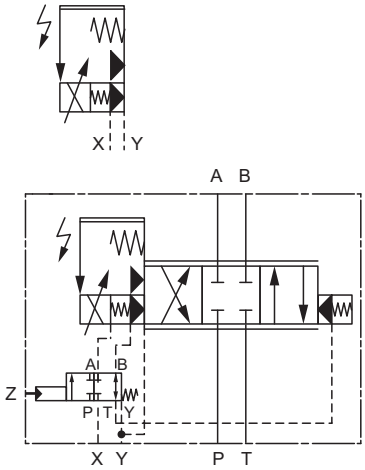
Fig. 90: Installation drawing for D945K (dimensions in mm)

Installation space for the connectors when mounted: a Fig. 23, page 74

*) Dimension with fixed cabling of pilot valve with explosion-proof cable glands. If the pilot valve cabling uses explosion-proof connectors, the valve installation height increases by 50 mm (1.97 in).

Fail-safe function H
4-way version

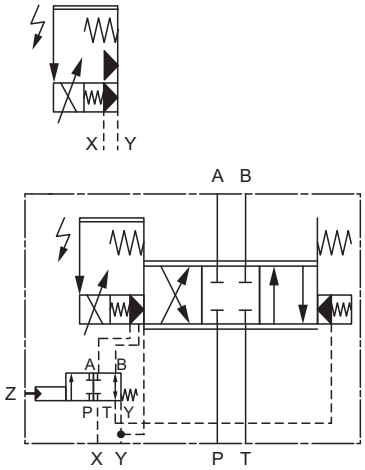
X and Y optionally external or internal



defined A→T

Fail-safe function K
4-way version

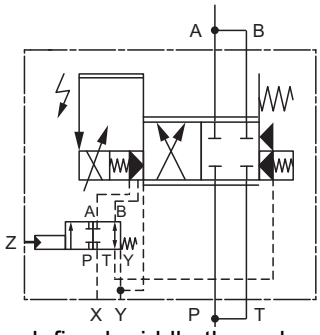
X and Y optionally external or internal



defined middle

Fail-safe function K
2/2-way version

only X and Y external



defined middle through mechanical stroke limitation

Execute flow direction according to symbols.

Characteristic curves, D945K valves with direct-operated pilot valve D633K

All characteristic curves in the section "Characteristic curves, D945K valves with pilot valve D633K" are typical characteristic curves for the D945K valve with pilot valve D633K with control/operating pressure p_P = 210 bar, viscosity of hydraulic fluid ν = 32 mm^2/s and temperature of hydraulic fluid T = 40 °C (104° F).

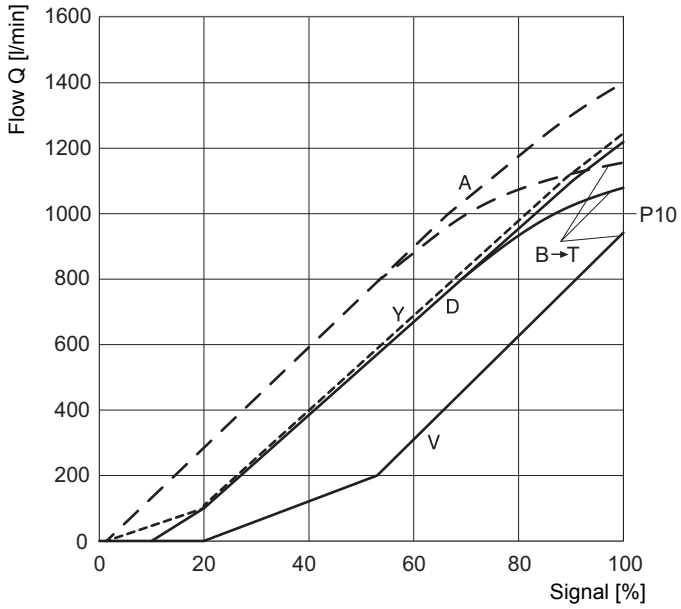
Flow diagram (4-way operation)

a Chap. "4.1 Flow diagram (4-way operation)", page 55

Flow diagram

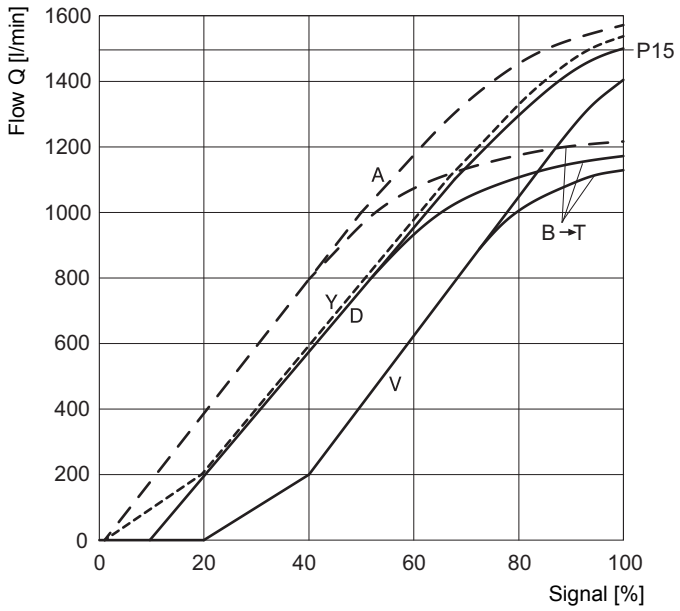
Flow signal characteristic curve at rated pressure drop Δp_N= 10 bar, that is, Δp_N = 5 bar per control land:

Flow signal characteristic curve



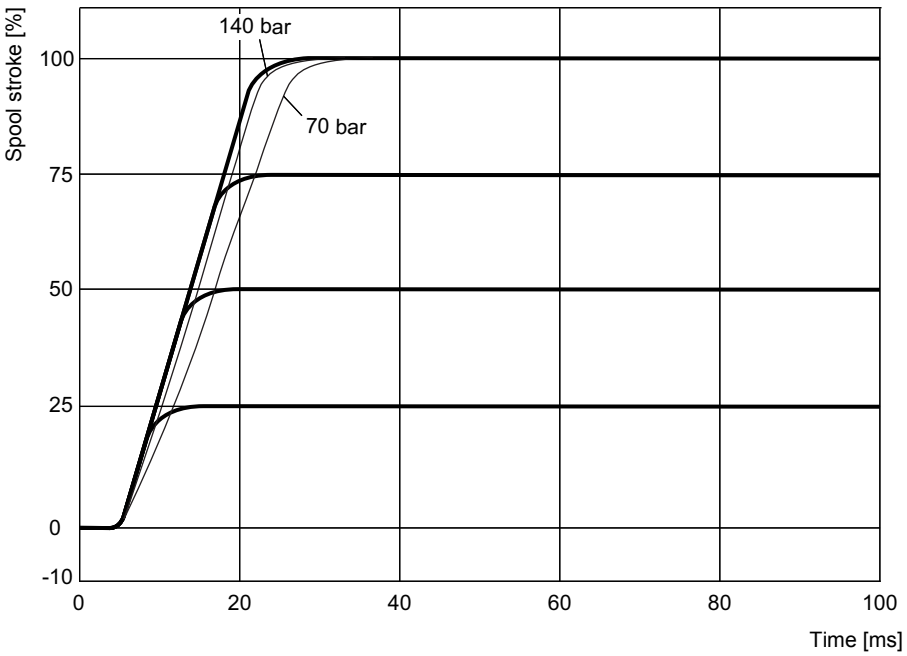
Spool **A**	≈ zero overlap, linear characteristic curve
Spool **D**	10 % positive overlap, linear characteristic curve
Spool **V**	20 % positive overlap, kinked characteristic curve
Spool **Y**	≈ zero overlap, dual gain flow characteristic
P10	type: standard spool rated flow 1000 l/min

Fig. 91: D945K valves, flow-signal characteristics, 1,000 l/min



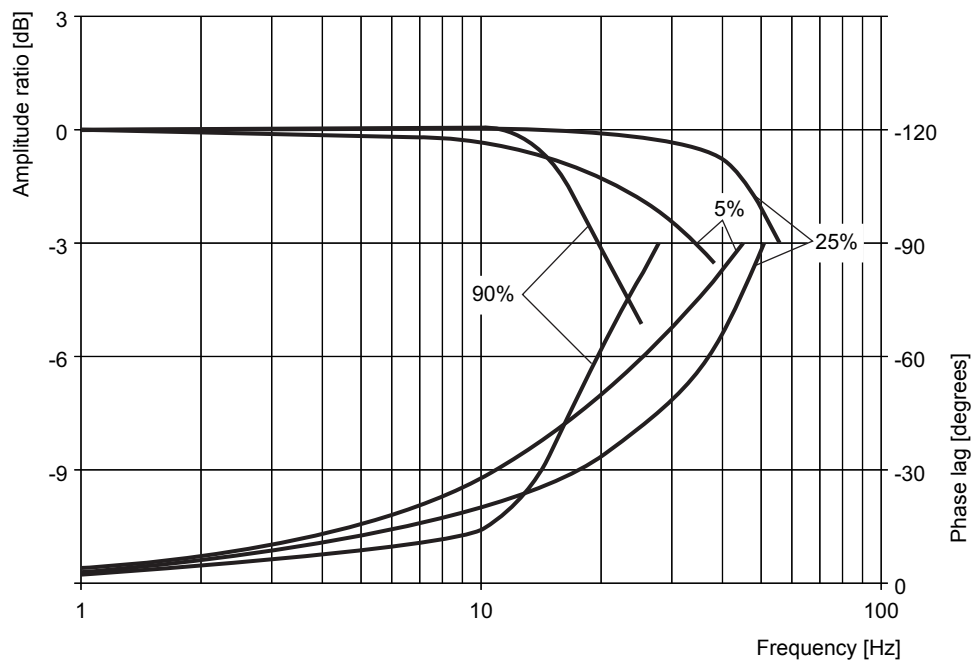
Spool **A**	≈ zero overlap, linear characteristic curve
Spool **D**	10 % positive overlap, linear characteristic curve
Spool **V**	20 % positive overlap, kinked characteristic curve
Spool **Y**	≈ zero overlap, dual gain flow characteristic
P15	type: standard spool rated flow 1500 l/min

Fig. 92: D945K valves, flow-signal characteristics, 1,500 l/min



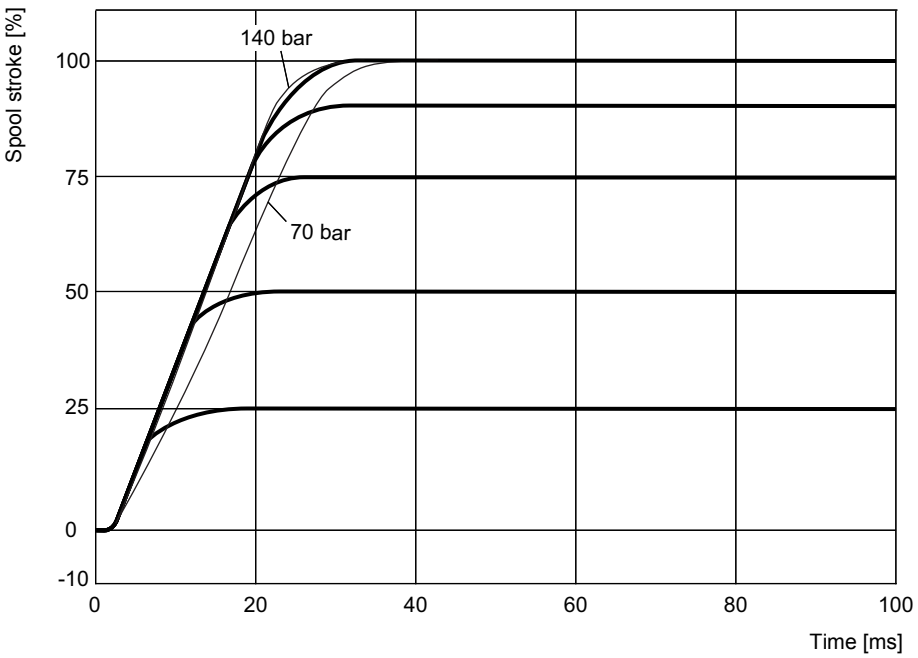
Step response for D945K valves with direct-operated pilot valve D633K, standard, stub shaft spool K10

Fig. 93: Step response for D945K valves, standard, stub shaft spool K10



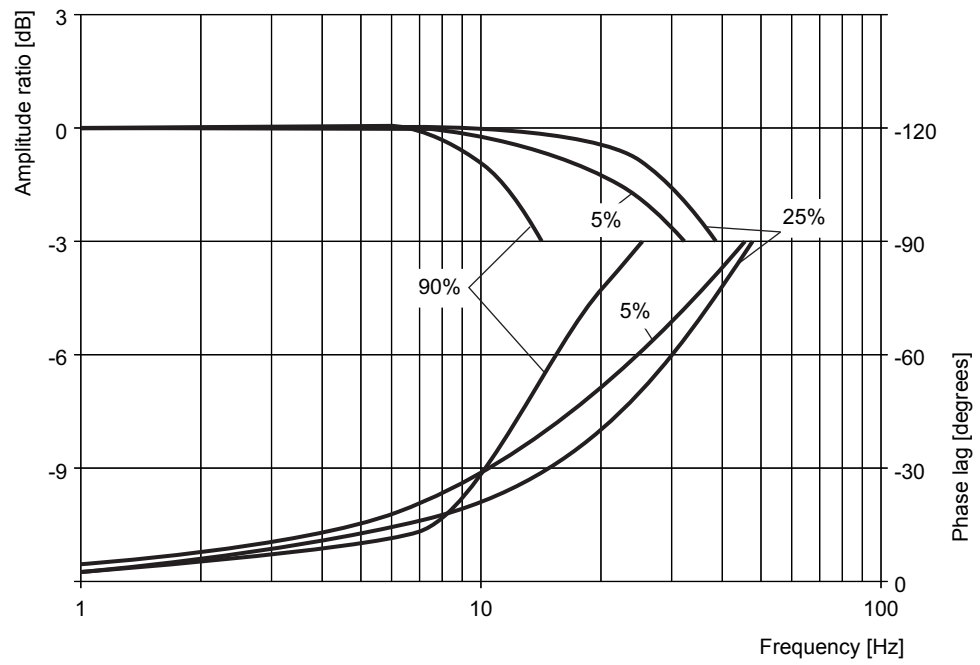
Frequency response for D945K valves with direct-operated pilot valve D633K, standard, stub shaft spool K10

Fig. 94: Frequency response for D945K valves, standard, stub shaft spool K10



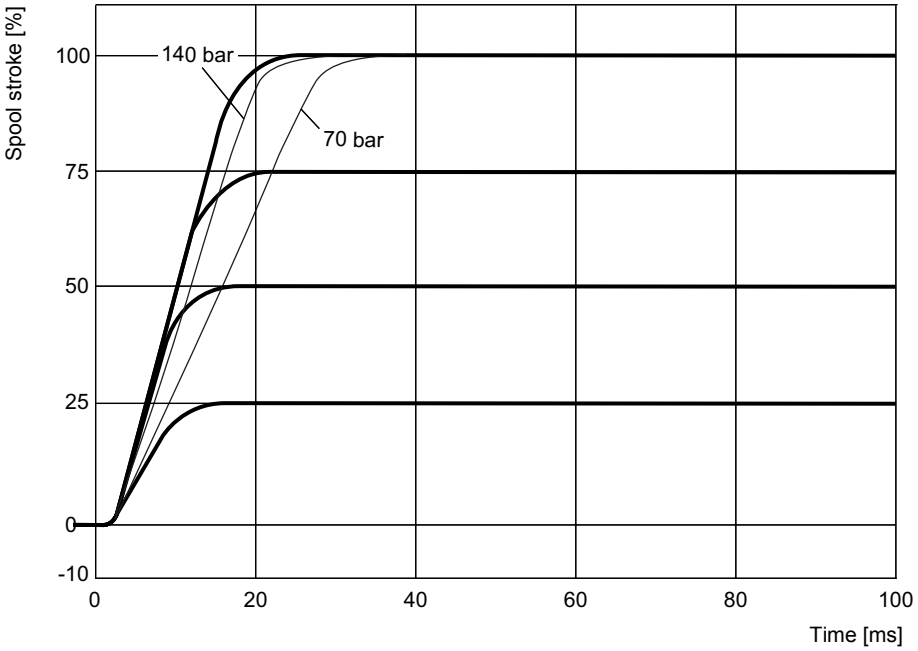
Step response for D945K valves with direct-operated pilot valve D633K, trimmed, stub shaft spool K10

Fig. 95: Step response for D945K valves, trimmed, stub shaft spool K10



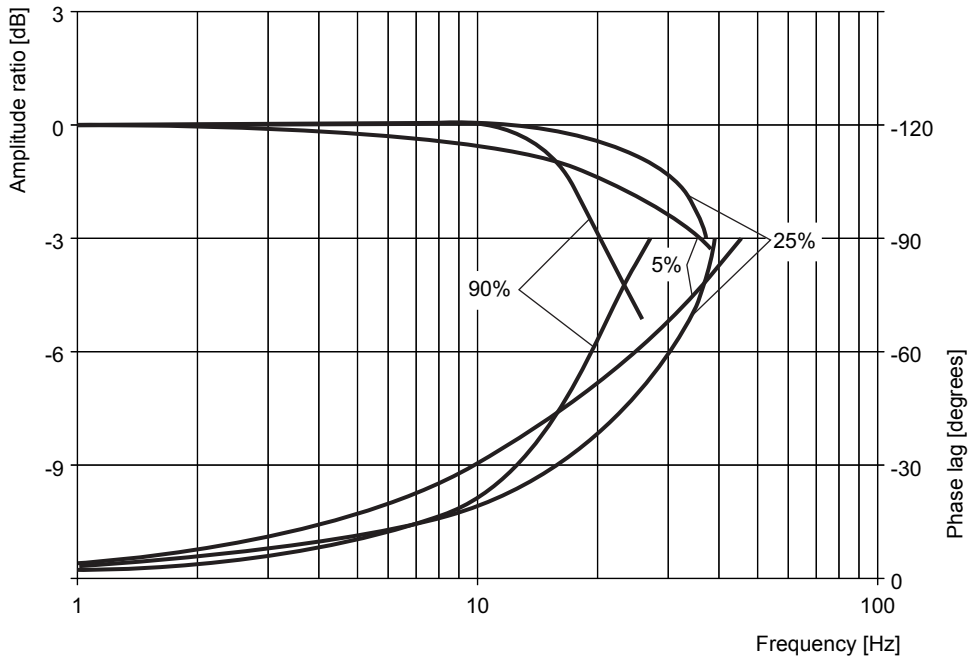
Frequency response for D945K valves with direct-operated pilot valve D633K, trimmed, stub shaft spool K10

Fig. 96: Frequency response for D945K valves, trimmed, stub shaft spool K10



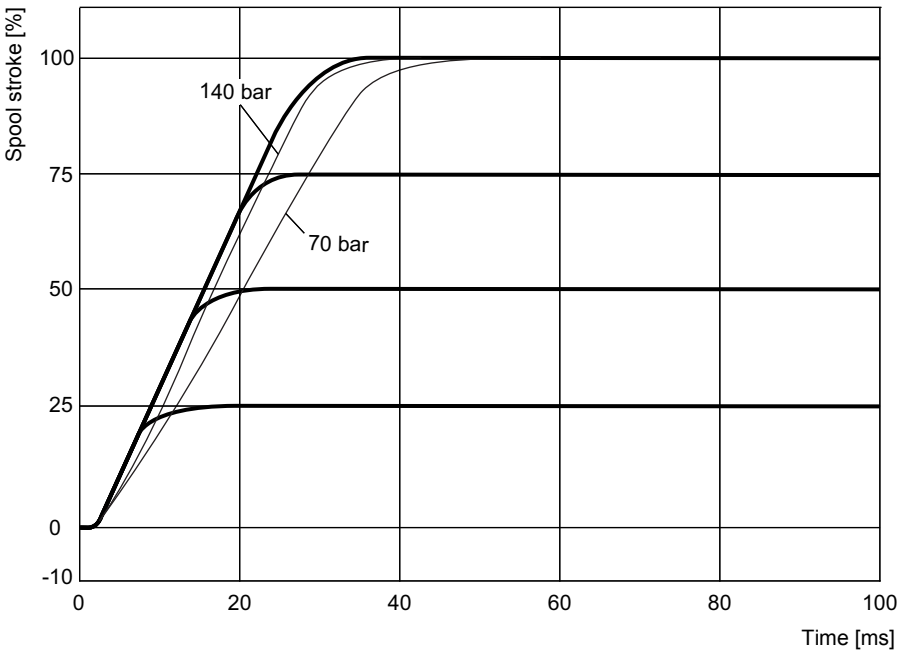
Step response for D945K valves with direct-operated pilot valve D633K, standard, stub shaft spool K15

Fig. 97: Step response for D945K valves, standard, stub shaft spool K15



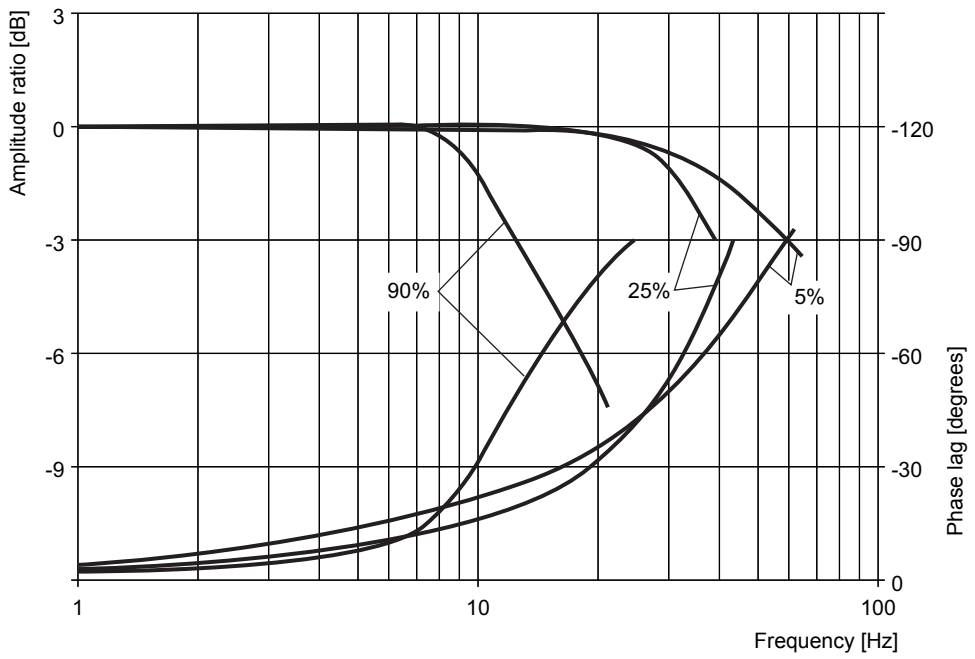
Frequency response for D945K valves with direct-operated pilot valve D633K, standard, stub shaft spool K15

Fig. 98: Frequency response for D945K valves, standard, stub shaft spool K15



Step response for D945K valves with direct-operated pilot valve D633K, trimmed, stub shaft spool K15

Fig. 99: Step response for D945K valves, trimmed, stub shaft spool K15



Frequency response for D945K valves with direct-operated pilot valve D633K, trimmed, stub shaft spool K15

Fig. 100: Frequency response for D945K valves, trimmed, stub shaft spool K15

12 Accessories, Spare Parts, and Tools

CAUTION

Danger of personal and property damage due to defective accessories and defective spare parts!
Unsuitable or defective accessories or unsuitable or defective spare parts may cause damage, malfunctions or failure of the valve or the machine.

- Use only original accessories and original spare parts.
- a Chap. "12 Accessories, Spare Parts, and Tools", page 232
- Warranty and liability claims for personal injury and damage to property are among other things excluded if they are caused by the use of unsuitable or defective accessories or unsuitable or defective spare parts.
- a Chap. "1.8 Warranty and liability", page 11

12.1 Accessories for valves in the D94xK type series

The accessories are Not included in scope of delivery
a Chap. "5.2 Scope of delivery of the valve", page 61

Cables of the connector cable that are not used must be insulated or insulated and placed in the control cabinet.

Item designation	Number required	Comments	Item number
Item name: Adapter cable M8-M12, 2 m (not approved for hazardous areas)	1		CA40934-001
USB start-up module (for service connector X10) not approved for use in hazardous areas	1		C43094-001
Configuration/start-up cable, 2 m not approved for hazardous areas	1		TD3999-137
SELV/PELV power pack (24 V DC, 10 A) not approved for hazardous areas	1		D137-003-001
Power supply cord, 2 m (not approved for hazardous areas)	1		B95924-002
Configuration / commissioning software (Moog Valve and Pump Configuration Software)	1		B99104
M8-M12 adapter cable	1		CA40934-001
Mating connector X1	1	Without cable, plug exlink, Fa. CEAG	CB22154-001
Mating connector X2	1	Without cable, plug exlink, Fa. CEAG	CB22150-001
Mating connector X5, X6, X7	3	Without cable, plug exlink, Fa. CEAG	CB22148-001
Mating connector CAN X3, X4	2	Without cable, plug exlink, Fa. CEAG	CB22142-001
Mating connector Profibus X3, X4	2	Without cable, plug exlink, Fa. CEAG	CB22145-001
Mating connector Ethercat X3, X4	2	Without cable, plug exlink, Fa. CEAG	CB22152-001
Connection cable X1	1	Mud-resistant cable with plug exlink, Fa. CEAG, cable length 20 m	CB22155-001
Connection cable X2	1	Mud-resistant cable with plug exlink, Fa. CEAG, cable length 20 m	CB22151-001

Tab. 42: Accessories and tools for all proportional valves in the D94xK type series (Part 1 of 2)

Item designation	Number required	Comments	Item number
Connection cable CAN X3, X4	2	Mud-resistant cable with plug exlink, Fa. CEAG, cable length 20 m	CB22346-001
Connection cable CAN X3, X4	1	Mud-resistant cable with plug exlink, Fa. CEAG, cable length 20 m With integrated terminal resistor - this cable can only be used to connect the last valve in the fieldbus chain	CB22144-001
Connection cable CAN X3, X4	2	Mud-resistant cable with plug exlink, Fa. CEAG, cable length 20 m This cable must be used if 24 V supply should be looped over the CAN bus. The terminal resistor must be external	CB22143-001
Connection cable Profibus X3, X4	2	Mud-resistant cable with plug exlink, Fa. CEAG, cable length 20 m	CB22146-001
Connection cable Profibus X3, X4	1	Mud-resistant cable with plug exlink, Fa. CEAG, cable length 20 m With integrated terminal resistor - this cable can only be used to connect the last valve in the fieldbus chain	CB22147-001
Connection cable Ethercat X3, X4	2	Mud-resistant cable with plug exlink, Fa. CEAG, cable length 20 m	CB22153-001
Connection cable X5, X6, X7	3	Mud-resistant cable with plug exlink, Fa. CEAG, cable length 20 m	CB22149-001
Pilot valve connection cable	1	Available optionally with cable routing instead of the fixed cabling This option must be specified when the valve is ordered a Chap. "13 Ordering Information", page 237, character 5 of the type designation	CB22861-001
Present documentation			
User manual type series D94xK, German	1		CDS29589-de
User manual type series D94xK, English	1		CDS29589-001
Supplemental documents			
Manual: Moog Valve and Pump Configuration Software, German	1		on request
Manual: Moog Valve and Pump Configuration Software, English	1		on request
TN 494	1	Permissible lengths of electric connection cables for valves with integrated electron-ics	CA48851
TN 353	1	Equipotential bonding and protective grounding of hydraulic valves with inte-grated electronics	CA58437
TN 502	1	Valves with EtherCAT interface	CA56678
User manual for Digital Interface Valves with EtherCAT Interface Firmware B9926-DV013-B-211	1	Valves with EtherCAT interface	CDS33722-en
Documents can be found and downloaded by specifying the item number: For German documents, go to http://www.moog.de/german/about-moog-inc/industrial-group-literature-library/ For English documents, go to http://www.moog.com/industrial/literature			

Tab. 42: Accessories and tools for all proportional valves in the D94xK type series (Part 2 of 2)

12.2 Tools for valves in the D94xK type series

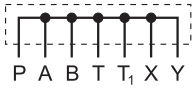
Item designation	Comments	Item number
Tools for the mating connectors of the connectors	Crimping tool for mating connector	see operating instructions eXLink, CEAG

Tab. 43: Tools for valves in the D94xK type series

12.3 NG-dependent accessories and spare parts

The accessories are Not included in scope of delivery
a Chap. "5.2 Scope of delivery of the valve", page 61

12.3.1 Proportional valves in the D941K type series

Item designation	Number required	Comments	Item number
Flushing plates			
for ports P, A, B, T, T1, X, Y	1		B67728001
for ports P, T, T1 and X, Y	1		B67728-002
for ports P, T, T1, X, Y	1		B67728-003
Connecting plates			
Service sealing set lower level		NBR 85 Shore FKM 85 Shore	B97215-N681-10 B97215-V681-10
Contains following O-rings:			
for ports A, B, P, T1 and X	6	ID 12.4 x dia. 1.8 [mm] (0.49 x 0.07 in) NBR 85 Shore FKM 85 Shore	-45122-004 -42082-004
for port Y	1	ID 15.6 x dia. 1.8 [mm] (0.61 x 0.07 in) NBR 85 Shore FKM 85 Shore	-45122-011 -42082-011
Service sealing set pilot valve or fail-safe valve	 1 1	 Set NBR 85 Shore Set FKM 85 Shore	 B97215-N630F63 B97215-V630F63
Attachment screws	4	M6x40 EN ISO 4762 10.9 Tightening torque: 11 Nm (8 lbf ft) ± 10 %	A03665--060--040

Tab. 44: Spare parts and accessories in the D941K type series with direct-operated pilot valve D633K

12.3.2 Proportional valves in the D942K type series

Item designation	Number required	Comments		Item number
Flushing plate				-76741
Connecting plate				B97138-001
Attachment screws				
attachment screws	4	M10x60 EN ISO 4762 10.9 Tightening torque: 54 Nm (40 lbf ft) ± 10 %		A03665-100-060
attachment screws	2	M6x55 EN ISO 4762 10.9 Tightening torque: 11 Nm (8 lbf ft) ± 10 %		A03665-060-055
Service sealing set lower level			NBR 85 Shore FKM 85 Shore	B97215-N6X2-16 B97215-V6X2-16
Contains following O-rings:				
for ports A, B, P and T	4	ID 21.89 x dia. 2.6 [mm] (0.86 x 0.10 in)	NBR 85 Shore FKM 85 Shore	-45122-129 -42082-129
for ports X and Y	2	ID 10.82 x dia. 1.8 [mm] (0.43 x 0.07 in)	NBR 85 Shore FKM 85 Shore	-45122-022 -42082-022
Service sealing set pilot valve **or fail-safe valve**	1 1	Set Set	NBR 85 Shore FKM 85 Shore	B97215-N630F63 B97215-V630F63

Tab. 45: Spare parts and accessories in the D942K type series with direct-operated pilot valve D633K

12.3.3 Proportional valves in the D943K and D944K type series

Item designation	Number required	Comments		Item number
Flushing plate				-76047-001
Connecting plate				A25855-009
attachment screws	6	M12x75 EN ISO 4762 10.9 Tightening torque: 94 Nm (69 lbf ft) ± 10 %		A03665-120-075
Service sealing set lower stage			NBR 85 Shore FKM 85 Shore	B97215-N6X4-25 B97215-V6X4-25
Contains following O-rings:				
for ports A, B, P and T	4	ID 34.60 x dia. 2.6 [mm] (1.36 x 0.10 in)	NBR 85 Shore FKM 85 Shore	-45122-113 -42082-113
for ports X and Y	2	ID 20.92 x dia. 2.6 [mm] (0.82 x 0.10 in)	NBR 85 Shore FKM 85 Shore	-45122-195 -42082-195
Service sealing set pilot valve **or fail-safe valve**	1 1	Set Set	NBR 85 Shore FKM 85 Shore	B97215-N630F63 B97215-V630F63

Tab. 46: Spare parts and accessories in the D943K and D944K type series with direct-operated pilot valve D633K

12.3.4 Proportional valves in the D945K type series

Item designation	Number required	Comments		Item number
Flushing plate				not available
Connecting plate				A25855-001
attachment screws	6	M20x90 EN ISO 4762 10.9 Tightening torque: 460 Nm (339 lbf ft) ± 10 %		A03665-200-090
Service sealing set lower stage			HNBR 85 Shore FKM 85 Shore	B97215-S6X5-32 B97215-K6X5-32
Contains following O-rings:				
for ports A, B, P and T	4	ID 53.60 x dia. 3.5 [mm] (2.11 x 0.14 in)	HNBR 85 Shore FKM 85 Shore	B97217-227H B97217-227V
for ports X and Y	2	ID 14.00 x dia. 1.8 [mm] (0.55 x 0.07 in)	HNBR 85 Shore FKM 85 Shore	B97217-015H B97217-015V
Service sealing set pilot valve or fail-safe valve	 1 1	 Set Set	 NBR 85 Shore FKM 85 Shore	 B97215-N630F63 B97215-V630F63
Service sealing set fail-safe adapter plate	 1 1	 Set Set	 NBR 85 Shore FKM 85 Shore	 B97215-N681-10 B97215-V681-10

Tab. 47: Spare parts and accessories in the D945K type series with direct-operated pilot valve D633K

13 Ordering Information

Model no. (specified by factory)

D941 - D945	X	. . . .	-	

Type designation

1	2	3	4	5	6
.	.	.	.	-	.

Specification status	
K	Explosion-proof mode

Model variant

Variant

1	Spool model	Series
P	Standard spool	D941K to D944K
B	Standard spool (5-way)	D941K (with P_1 connection)
K	Step piston	D945K

2	Rated flow Q_N (l/min)	
	(at Δ p = 5 bar per control edge)	Series
08	8	D941K
30	30	D941K
60	60	D941K
80	80	D941K
01	150	D942K
02	250	D942K
03	350	D943K
05	550	D944K
10	1000	D945K
15	1500	D945K

3	Maximum operating pressure With internal control connection X, the max. operating pressure corresponds to the max. pilot pressure. The valve electronics are adapted to the control pressure.
W	25 bar
V	100 bar
U	160 bar
T	250 bar
K	350 bar

4	Spool model	
B	3-way:	P → A, A → T, ~ Zero overlap, linear characteristic curve
U	5-way:	P_1 → A, P_2 → B, A → T, ~ Zero overlap, broken characteristic curve
T	4-way:	linear characteristic curve
		P → A, P → B: 20 % positive overlap
		A → T, B → T: 15 % positive overlap
Z	2x2-way:	A → T, B → T_1: linear characteristic curve, closed with a (D941K) signal of 90% (can only be inserted in the bypass flow)
		P → B, T → A: only X and Y external (D942K to D945K)
	Others on request.	

5	Pilot valve	
S	Direct-operated pilot valve D633K, fixed cabling with ex-proof cable glands, not replaceable	D941K ... D945K
R	Direct-controlled pilot valve D633K	D941K ... D945K

6	Fail-Safe-Funktion
M	Middle position
F	P → B, A → T
D	P → A, B → T
K	Middle position
H	P → B, A → T
	Others on request.

. . . . 2 . . . . . .

16 Specified by the factory

15 Specified by the factory

14 Fieldbus connectors X3, X4

G	CAN
H	Profibus DP
J	EtherCAT
O	Without fieldbus interface

13 Enable function

A	When the enable signal is deactivated the spool takes up a settable controlled neutral position.
B	When the enable signal is deactivated the spool takes up the defined end position A → T and B → T.
K	When the enable signal is deactivated the spool takes up a settable controlled neutral position.
L	When the enable signal is deactivated the spool takes up the defined end position A → T and B → T.
	Others on request.

12 Valve design

N	Flow control with pressure limitation control above [1]
K	Flow control with pressure limitation control below [1]
C	Valve in bypass flow, flow control with pressure limitation control above [1]
M	Pressure control in main flow [2]

11 Electrical supply

2	24 V DC

10 Signals for 100% spool stroke

	Input signal	Measurement output
D	±10 V	2 to 10 V
E	4 to 20 mA	4 to 20 mA
M	±10 V	4 to 20 mA
X	±10 mA	4 to 20 mA
9	Field bus	Field bus
Y	Others on request.	

9 Ventil-Anbaustecker X1

J	7-polig

8	Gasket material	Series
H	HNBR	D941K to D944K
V	FKM	D941K to D945K
A	T-ECOPUR (-40° C)	D941K to D945K
B	FKM44 (-40° C)	D941K to D945K
S	Edge seal HNBR	D945K
	Others on request.	

7	Control type Intake X	Limitations for the selection: see hydraulic symbols Outlet Y
4	internal	internal
5	external	internal
6	external	external
7	internal	external

[1] Only in connection with valve functionality „C1“

[2] Only in connection with valve functionality „B1“

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

14 Keyword index

Symbols

Numerics

A

B

C

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

D

E

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

F

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

G

H

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

I

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

L

M

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

N

O

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

P

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Q

R

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

S

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

T

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

U

V

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

W

X

Y

Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

15 Appendix

15.1 Abbreviations, symbols and identification letters

Abbr.	Explanation
β_x	Symbol for filter fineness
Δp	symbol for pressure difference
Δp_N	symbol for rated pressure difference
ν	symbol for viscosity
A	Valve port (consumer port)
A/D	**A**nalog-**D**igital converter
ACV	**A**xis **C**ontrol **V**alve (valve with axis control function)
B	Valve port (consumer port)
CAN	**C**ontroller **A**rea **N**etwork
CANopen	Standardized communication profile
CiA	**C**AN **i**n **A**utomation e. V. (International Manufacturers' and Users' Organization for CAN Users; http://www.can-cia.org)
D	**D**ifferential (e. g.: in PID controller)
D	Fail-safe function **D** of valve
D/A	**D**igital-**A**nalog converter
DIN	**D**eutsches **I**nstitut für **N**ormung e. V. (German Institute for Standardization)(http://www.din.de)
DSP	**D**raft **S**tandard **P**roposal
EMC	**E**lectro**m**agnetic **C**ompatibility
EN	**E**uropa-**N**orm (European standard)
ESD	**E**lectro**s**tatic **D**ischarge
EU	**E**uropean **U**nion
F	Fail-safe function **F** of valve
F_1…F_4	Bore for installation screws or attachment screws for the shipping plate in the mounting pattern of the valve mounting surface
FKM	fluorocarbon rubber (material for gaskets, such as O-rings)
GND	**G**rou**nd**
HNBR	**H**ydrogenated **N**itrile **B**utadiene **R**ubber (material for gaskets, such as O-rings)
I	**I**ntegral (e.g. in PID controller)
I_{in}	Symbol for input current
I_{out}	Symbol for output current
$I_{Command}$	Symbol for current command signal
I_{Supply}	Symbol for supply current
ID	**Id**entifier
ID	**I**nner **D**iameter (e.g. on O-rings)
IEC	**I**nternational **E**lectrotechnical **C**ommission (http://www.iec.ch)
IP	**I**nternational **P**rotection (IP code; degree of protection type by enclosure as per EN 60529)
ISM	**I**ndustrial, **s**cientific and **m**edical (industrial, scientific, and medical, e. g. for ISM devices)
ISO	**I**nternational **O**rganization for **S**tandardization (http://www.iso.org)
LED	**L**ight **E**mitting **D**iode

Tab. 48: Abbreviations, symbols, and identification letters

Tab. 48: Abbreviations, symbols and identification letters (Part 1 of 3)

Tab. 48: Abbreviations, symbols, and identification letters

Abbr.	Explanation
LSS	**L**ayer **S**etting **S**ervices as per CiA DSP 305 (LSS offers the option of setting the node parameters, such as module address or transmission rate, of a CAN node via the CAN bus)
LVDT	**L**inear **V**ariable **D**ifferential **T**ransformer (position transducer; senses the position of the spool in the valve)
M	Fail-safe function **M** of valve
NBR	**N**itrile **B**utadiene **R**ubber (material for gaskets, such as O-rings)
NG	Nominal size of the valve, e.g. 610
P	**P**roportional (e.g. in PID controller)
P	Valve port (pressure port)
P_1	Valve port (pressure port)
P	Symbol for pressure (**P**ressure)
p_N	Symbol for rated pressure
p_P	Symbol for operating pressure
p_X	Symbol for pilot pressure
PC	**P**ersonal **C**omputer
PE	**P**rotective **E**arth
PE	Pin of the 11+PE-pin valve connector X1
PELV	**P**rotective **E**xtra **L**ow **V**oltage
PID	**P**roportional **I**ntegral **D**ifferential (e. g. in PID controller)
PWM	**P**ulse **W**idth **M**odulation
Q	Symbol for flow
Q	Symbol for flow rate of a pump
Q_L	Symbol for leakage flow
Q_{max}	Symbol for maximum flow
Q_N	Symbol for rated flow
R_a	Symbol for average roughness
R_{In}	Symbol for input resistance
R_L	Symbol for load impedance
SELV	**S**afety **E**xtra **L**ow **V**oltage (low voltage)
WAF	**W**idth **A**cross **F**lats for wrenches
T	Symbol for temperature
T	Valve port (tank port)
T_1	Valve port (tank port)
T	Symbol for time
TN	**T**echnical **N**ote
TÜV	**T**echnischer **Ü**berwachungs**v**erein (German Technical Inspection Agency)
U_{in}	Symbol for input voltage
U_{out}	Symbol for output voltage
U_{comm}	Symbol for input voltage command signal
U_{cable}	Symbol for voltage drop on the cable
USB	**U**niversal **S**erial **B**us
UV	**U**ltra**v**iolet
V	Symbol for volume (such as tank capacity)
VDE	**V**erband **d**er **E**lektrotechnik Elektronik Informationstechnik e. V. (German Association of Electrical Engineering, Electronics and Information Technology) (http://www.vde.de)

Tab. 48: Abbreviations, symbols and identification letters (Part 2 of 3)

Abbr.	Explanation
VDI	**V**erein **D**eutscher **I**ngenieure e. V. (Association of German Engineers) (http://www.vdi.de)
W	Fail-safe function **W** of valve
X	Valve port (pilot pressure port)
X1…X10	Designations for the valve connectors
Y	Valve port (leakage port)

Tab. 48: Abbreviations, symbols and identification letters (Part 3 of 3)

Tab. 48: Abbreviations, symbols, and identification letters

15.2 Additional literature

15.2.1 Fundamentals of hydraulics

Additional literature: fundamentals of hydraulics

Findeisen, Dietmar und Findeisen, Franz:
Ölhydraulik; Springer-Verlag

Murrenhoff, Univ.-Prof. Dr.-Ing. Hubertus:
Grundlagen der Fluidtechnik - Teil 1: Hydraulik (Vorlesungsumdruck des IFAS der RWTH Aachen)
http://www.rwth-aachen.de/ifas

Murrenhoff, Univ.-Prof. Dr.-Ing. Hubertus:
Servohydraulik (Vorlesungsumdruck des IFAS der RWTH Aachen)
http://www.rwth-aachen.de/ifas

Murrenhoff, Univ.-Prof. Dr.-Ing. Hubertus:
Steuerungs- und Schaltungstechnik II (Vorlesungsumdruck des IFAS der RWTH Aachen)
http://www.rwth-aachen.de/ifas

Schäfer, Dr. Klaus D.:
Stetighydraulik - Grundlagen, Ventiltechnik, Regelkreise; Die Bibliothek der Technik, Band 215; Verlag Moderne Industrie

15.2.2 CAN fundamentals

Additional literature: CAN fundamentals

CAN in Automation e. V.:
http://www.can-cia.org

Etschberger, Konrad (editor):
CAN - Controller-Area-Network - Grundlagen, Protokolle, Bausteine, Anwendungen; Carl Hanser Verlag

Lawrenz, Wolfhard (editor):
CAN - Controller Area Network - Grundlagen und Praxis; Hüthig Verlag

15.2.3 Profibus fundamentals

Additional literature: Profibus fundamentals

PROFIBUS Users' Organization:
http://www.profibus.com

Popp, Manfred:
PROFIBUS-DP/DPV1 - Grundlagen, Tipps und Tricks für Anwender; Hüthig Verlag

15.2.4 EtherCAT fundamentals

EtherCAT Technology Group:
http://www.ethercat.org

Additional literature:
EtherCAT fundamentals

15.2.5 Moog publications

Additional literature: Publications by our company

Press releases:
http://www.moog.com/industrial/news

Newsletters:
http://www.moog.com/industrial/newsletter

Articles in technical journals:
http://www.moog.com/industrial/articles

Presentations and scientific publications:
http://www.moog.com/industrial/papers

User manual, TNs, catalogs, and similar:
http://www.moog.com/industrial/literature

15.3 Quoted standards

15.3.1 CiA DSP

Quoted standards: CiA DSP

CiA DSP 305
CiA Draft Standard Proposal: CANopen Layer Setting Services and Protocol (LSS)

15.3.2 TIA/EIA

Quoted standards: TIA/EIA

ANSI/TIA/EIA-568-B.1
Commercial Building Telecommunications Cabling Standard Part 1: General Requirements

EIA 422
Electrical Characteristics of Balanced Voltage Digital Interface Circuits

TIA/EIA-485-A
Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems

15.3.3 IEC

Quoted standards: IEC

IEC 62407
Real-time Ethernet control automation technology (EtherCATTM)

15.3.4 IEEE

Quoted standards

IEEE 802.3
Carrier Sense Multiple Access with Collision Detection (CSMA/CD) -Access Method and Physical Layer

15.3.5 ISO, ISO/IEC

Quoted standards: ISO, ISO/IEC

ISO 11898
Road vehicles – CAN protocol

ISO/IEC 8802-3
Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks, specific requirements - Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications

15.3.6 DIN

DIN 51524-1
Pressure fluids; Hydraulic oils Part 1: HL hydraulic oils; Minimum requirements

DIN 51524-2
Pressure fluids; Hydraulic oils Part 2: HLP hydraulic oils; Minimum requirements

DIN 51524-3
Pressure fluids; Hydraulic oils Part 3: HVLP hydraulic oils; Minimum requirements

DIN 24340-2
Hydraulic valves; hole patterns, and connecting plates for mounting Directional Control valves

15.3.7 EN

Quoted standards: EN

EN 563
Safety of machinery – Temperatures of touchable surfaces – Ergonomics data to establish temperature limit values for hot surfaces

EN 982
Safety of machinery – Safety requirements for fluid power systems and their components – Hydraulics

EN 55011
Industrial, Scientific And Medical Equipment (ISM devices) –Radio-frequency Disturbance Characteristics –Limits And Methods Of Measurement

EN 60068-2-6
Environmental tests – Part 2: Tests; test Fc: vibration, sinus-shaped (IEC 60068-2-6:1995 + Corrigendum 1995)

EN 60068-2-27
Environmental tests – Part 2: Tests; test Ea and guidelines: shocks (IEC 60068-2-27:1987)

EN 60079-0
Explosive atmospheres - Part 0: Equipment - General requirements

EN 60079-1
Electrical apparatus for explosive gas atmospheres - Part 1: Flameproof enclosures "d"

EN 60079-7
Explosive atmospheres - Part 7: Equipment protection by increased safety "e"

EN 60204
Safety of machinery – Electrical equipment of machines

EN 60529
Protection types provided by enclosures (IP code)

EN 61000-6-2
Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity to interference for industrial environments

EN 61000-6-3
Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emitted interference for residential, commercial and light-industrial environments

EN 61000-6-4
Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emitted interference for industrial environments

EN 61076-2-101
Connectors for electronic equipment - Part 2-101: circular connectors - type specification for circular connector M8 with screw or snap locking and M12 with screw locking for low-voltage applications

EN 61558-1
Safety of power transformers, power supplies, reactors and similar products – Part 1: General requirements and tests

EN 61158-2
Digital data communication in instrumentation and control – Field bus for industrial control systems

EN 61558-2-6
Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1100 V – Part 2-6: Special requirements and tests for safety transformers and power supplies that contain safety transformers

EN 175201-804
Type specification –Circular connectors – Round contacts, size diameter 1.6 mm –threaded coupling

EN 175301-803
Type specification Rectangular connectors Flat contacts, 0.8 mm (0.031 in) thickness, locking screw not detachable

15.3.8 EN ISO

Quoted standards: EN ISO

EN ISO 1302
Geometrical Product Specifications (GPS) Indication of surface texture in technical product documentation

EN ISO 4762
Hexagon socket head cap screws

EN ISO 12100
Safety of machinery – Basic concepts, general principles for design

EN ISO 13849
Safety of people – Safety-related parts of controllers

EN ISO 13849-1
Safety of machinery – Safety-related parts of control systems – Part 1: General design principles

15.3.9 ISO

Quoted standards: ISO

ISO 4401
Hydraulic fluid power – 4-port directional control valves – Mounting surfaces

ISO 4406
Hydraulic fluid power – Fluids – Method for coding level of contamination by solid particles

ISO 11158
Lubricants, industrial oils and related products (class L) -- Family H (hydraulic systems) -- Specifications for categories HH, HL, HM, HV and HG

15.4 Quoted directives

Quoted directives

2006/42/EC
Directive 2006/42/EG of the European Parliament and Council for alignment of the legal and administrative provisions of the Member States for machinery

2004/108/EC
Directive 2004/108/EC concerning electromagnetic compatibility (EMC)

94/9/EC
ATEX product directive

1999/92/EC
ATEX operating directive

VDI offers numerous directives for downloading:
http://www.vdi-nachrichten.com/ce-richtlinien/basics/richtlinien.asp.

15.5 Explosion-proof connectors

Instructions from the company Cooper Crouse-Hinds GmbH

eXLink 4-polig Stecker, Kupplung/
4-pole plug, coupler/
4 pôles fiche, prolongateur

COOPER Crouse-Hinds

Technische Angaben

Gerätekennzeichnung nach 94/9/EG und Norm:	
	Ⓔx II 2 G Ex de IIC T6
	Ⓔx II 2 G Ex ia/ib IICT6
	Ⓔx II 2 D Ex tD A21 IP 66 T80°C
nach CSA	Class I, Zone 1 Ex de IIC T6
	Class I, Div 2; Gr. A,B,C,D
EG-Baumusterprüfbescheinigung:	
	PTB 03 ATEX 1016 X
Zulässige Umgebungs-temperatur:	-25°C/-55°C bis +40°C[1)]
Bemessungsspannung:	bis 250 V, 50/60 Hz
Bemessungsstrom:	max. 10 A
Leitungseinführung ø:	Standard Optional
Stecker, Kupplung	ø4-7,5mm ø7,5-11mm
Anschlussquerschnitt:	1x0,75-1,5mm²/2,5mm²
Anschlussleitung	Draka ToughCat 7 LSHF-FR 4x2/0,27 MUD
Vibrationsfestigkeit nach EN 60068-2-6 10-150 Hz:	2g / 30 min[2)]
Prüfdrehmomente:	
Arretierungsschraube	1,0 Nm
Überwurfmutter	2,5 Nm
Druckschraube -ø 4-7,5mm	3,5 Nm
Druckschraube -ø7,5-11mm	3,5 Nm

1) die besonderen Bedingungen gemäß Prüfschein PTB 03 ATEX 1016 X sind zu beachten.
2) Die Hinweise im Kapitel „Montage“ beachten!

Technical Data

Apparatus marking acc. to 94/9/EC & directive	
	Ⓔx II 2 G Ex de IIC T6
	Ⓔx II 2 G Ex ia/ib IICT6
	Ⓔx II 2 D Ex tD A21 IP 66 T80°C
acc. CSA	Class I, Zone 1 Ex de IIC T6
	Class I, Div 2; Gr. A,B,C,D
EC type examination certificate:	
	PTB 03 ATEX 1016 X
Permissible ambient temperature:	-25°C/-55°C to +40 °C[1)]
Rated voltage:	up to 250 V, 50/60 Hz
Rated current:	max. 10 A
Cable entry ø:	Standard Optional
Plug, coupler	ø4-7.5mm ø7.5-11mm
Terminal cross section:	1x0.75-1.5mm²/2.5mm²
Cable:	Draka ToughCat 7 LSHF-FR 4x2/0.27 MUD
Vibration resistance acc. EN 60068-2-6 10-150 Hz:	2g / 30 min[2)]
Test torques:	
Locking screw	1.0 Nm
Coupling nut	2.5 Nm
Pressure screw -ø 4-7,5mm	3.5 Nm
Pressure screw -ø7,5-11mm	3.5 Nm

1) observe special requirements accd. certifcation PTB 03 ATEX 1016 X.
2) Follow the instructions in the chapter ´Installation!

Caractéristiques techniques

Marquage de l’appareil selon 94/9/CE & directive	
	Ⓔx II 2 G Ex de IIC T6
	Ⓔx II 2 G Ex ia/ib IICT6
	Ⓔx II 2 D Ex tD A21 IP 66 T80°C
en fonction de CSA	Class I, Zone 1 Ex de IIC T6
	Class I, Div 2; Gr. A,B,C,D
Attestation d’examen CE de type:	
	PTB 03 ATEX 1016 X
Température ambiante admissible:	-25°C/-55°C à +40°C[1)]
Tension nominale:	jusqu’à 250 V, 50/60 Hz
Courant nominal:	max. 10 A
Entrée de câble ø:	Standard Optional
Fiche, Prolongateur	ø4-7,5mm ø7,5-11mm
Section raccordement:	1x0,75-1,5mm²/2,5mm²
Cable:	Draka ToughCat 7 LSHF-FR 4x2/0,27 MUD
Résistance aux vibrations selon EN 60068-2-6 10-150 Hz:	2g / 30 min[2)]
Couples de serrage testés:	
Vis d´arrêt	1,0 Nm
Collerette de fixation	2,5 Nm
Vis de serrage ø 4-7,5mm	3,5 Nm
Vis de serrage ø7,5-11mm	3,5 Nm

1) Respecter les précautions particulières selon l'attestation d'examen CE de type PTB 03 ATEX 1016 X
2) Suivre les instructions du chapitre ´Montage!

Sicherheitshinweise

Vor dem Öffnen der Druckschraube am Stecker und Kupplung, ist die Spannungsfreiheit sicherzustellen. Die Montageanleitung darf nur zusammen mit der ausführlichen Betriebsanleitung „GHG5707001P0001“ (unter www.ceag.de erhältlich) verwendet werden. Die Benutzerinformationen für „MOOG-Ventile“ sind zu beachten (www.Moog.com/industrial). Das Konfektionieren der Steck-verbinder darf nur durch Fachkräfte erfolgen. Die Steckverbindungen eXLink sind nicht für den Einsatz in der Zone 0 oder 20 geeignet. Zur Sicherstellung des Explosionsschutzes dürfen in die Bohrungen von druckfesten Gehäusen nur Gerätestecker und Flansch-steckdosen aus Metall eingesetzt werden. Gerätestecker und Flanschsteck-dosen aus Metall sind durch geeignete Maßnahmen in das Erdpotential der Gehäuse bzw. Geräte mit einzubeziehen. Die unter Spannung stehenden Steckverbindungskomponenten müssen sofort nach dem Trennen mit der Schutzkappe verschlossen werden, damit die Schutzart und damit der Explosionsschutz sichergestellt wird.

Safety instructions

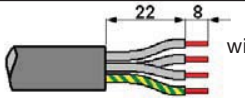
Before opening the pressure screw on the plug and coupler, ensure that it has been isolated from the supply. The assembly instructions must be used in conjunction with the detailed operating instructions „GHG5707001P0001” (available from www.ceag.de). The user information for „MOOG-Ventile“ must to be observed (www.Moog.com/industrial). The configuration of plug and socket systems shall only be carried out by qualified personnel. Plug and socket systems of the type eXLink are not suited for use in Zone 0 or 20 areas. In order to guarantee the explosion protection, only inlets and flange sockets made of metal may be fitted in the boreholes of flameproof enclosures. The metal flang sockets and inlets shall be incorporated in the earth potential eyualization. When opened, the live plug and socket system components shall be sealed immediately after disconnection using the protective cap. Here it is necessary to ensure that it is closed correctly, otherwise the minimum degree of protection and the explosion protection are no longer guaranteed.

Instructions de sécurité

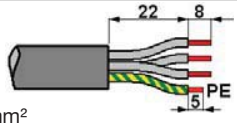
Avant de relâcher la vis de pression sur la prise et le prolongateur, vérifiez l’absence de tension. Utilisez la notice de montage uniquement en association avec les instructions détaillées de service “GHG5707001P0001” (disponibles sur le site www.ceag.de). Les informations utilisateur pour les „MOOG-Ventile“ doivent être respectées (www.Moog.com/industrial). Seul un personnel qualifié est autorisé à effectuer le branchement électrique des connecteurs mâles-femelles. Les connecteurs mâles-femelles eXLink ne conviennent pas pour une utilisation en zone 0 et 20. Afin de garantir une protection antidéflagrante, seuls des socles connecteurs et des prises de courant à bride métalliques doivent être montés dans les évidements des boîtiers à l’épreuve de la pression. Les prises à bride aux métal et les sockles connecteur aux métal doivent être reliés au même potentiel. Après déconnexion, les éléments de connexion encore sous tension doivent immédiatement être protégés à l’aide d’obturateurs.

GHG 570 7001 P0101 D/E/F (a)/Auflage/38.11/Str

Montageanleitung / Mounting instructions / Mode d'emploi



ohne PE-Bügel
without PE-shackle
sans étrier de PE

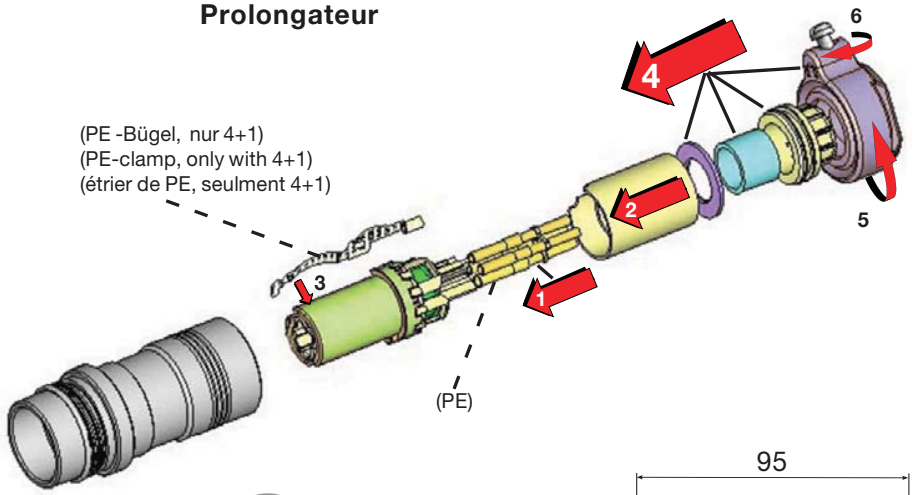


mit PE-Bügel
with PE-shackle
avec étrier de PE

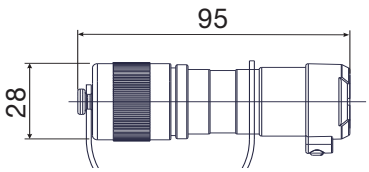
Anschlussquerschnitt	0,75 - 1,5mm² oder	2,5mm²
Cross section	0.75 - 1.5mm² or	2.5mm²
Section de raccordement	0,75 - 1,5mm² ou	2,5mm²

Kupplung
Coupler
Prolongateur

(PE -Bügel, nur 4+1)
(PE-clamp, only with 4+1)
(étrier de PE, seulment 4+1)

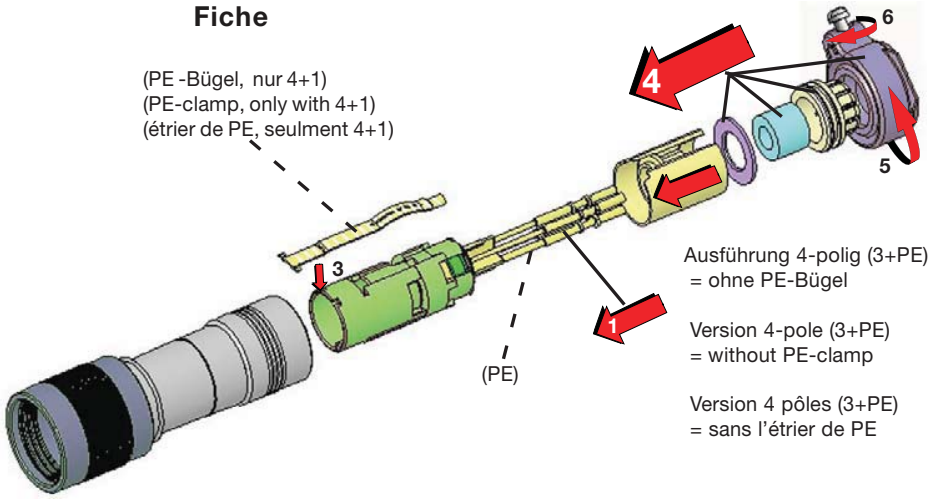


6 h



Stecker
Plug
Fiche

(PE -Bügel, nur 4+1)
(PE-clamp, only with 4+1)
(étrier de PE, seulment 4+1)



Ausführung 4-polig (3+PE)
= ohne PE-Bügel

Version 4-pole (3+PE)
= without PE-clamp

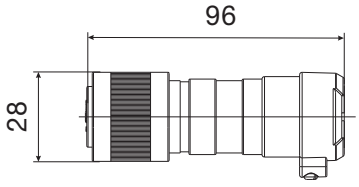
Version 4 pôles (3+PE)
= sans l'étrier de PE

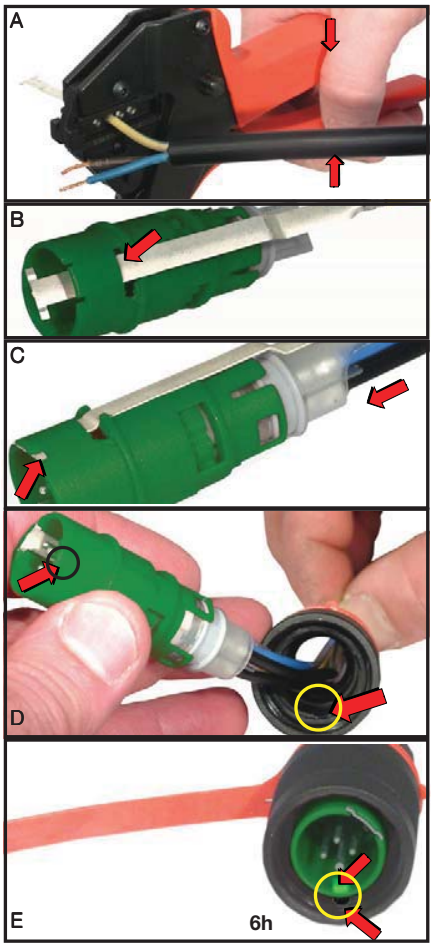
1 h

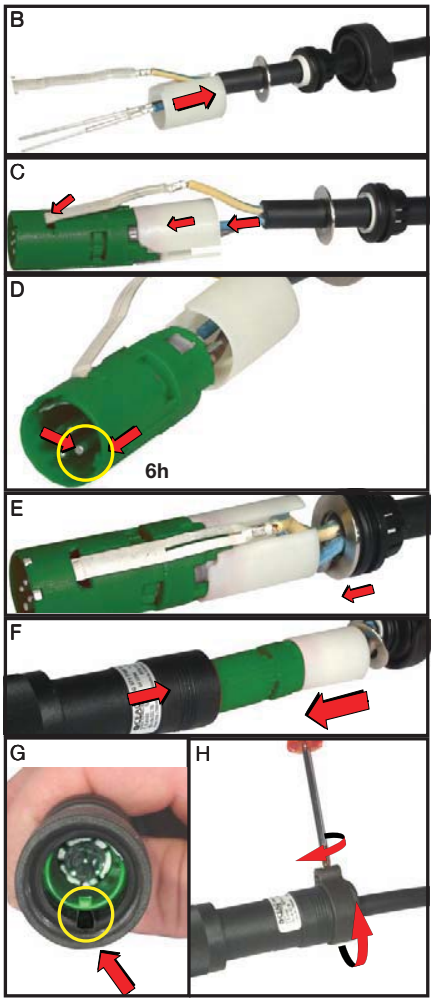
5 h

6 h

10 h







Stecker/Kupplung öffnen

1. Eventuell vorhandene Schutzkappe abschrauben.
2. Arretierschraube lösen.
3. Druckstück aus Hülse herausdrehen.
4. Einsatz von vorne aus der Hülse herausdrücken.
5. Dabei Zugentlastung, Dichtung, Druckscheibe, Isolierhülse aus Hülse nach hinten heraus nehmen.
6. Farbring zur Kennzeichnung auf Hülseaufziehen.

Plug open

1. Screw down possible excisting protective cap. .
2. Loosen locking screw.
3. Screw out pressure piece of plug sleeve.
4. Press out from front plug insert out of plug sleeve.
5. At the same time, remove the strain relief, seal, thrust washer and insulating sleeve from the plug sleeve from the back.
6. Fit coloured ring used for marking on to the plug sleeve.

Ouverture de la fiche

1. Dévisser le capuchon (si monté) de la fiche.
2. Dévisser la vis d'arrêt.
3. Sortir en la tournant la pièce de pression de la douille de fiche.
4. Extraire par l'avant le bloc de fiche de la douille de fiche.
5. Retirer pendant cette opération par l'arrière la décharge de tension, le joint, la rondelle de pression, la douille isolante de la douille de fiche.
6. Monter la bague en couleur comme repère sur la douille de fiche.

Leiter mit Stiften / Buchsen verbinden

⚠ Die Isolation des Leiters muss bis an die Stifte / Buchsen heranreichen. Der Leiter darf nicht beschädigt sein.

1. Kabel ca. 30 mm abmanteln.(Fig.1)
2. Leiter des Kabels ca. 8 mm ab-isolieren.

Stifte / Buchsen anschließen

1. Leiter in die Anschlussöffnung der Stifte / Buchsen stecken.
2. Alle Leiter mit der Crimpzange (→ Zubehör) ancrimpen (Fig.A).
   oder
   Alle Leiter mit Stiften/Buchsen verlöten und
   Schrumpfschlauch über jede Lötstelle ziehen.

Stecker/Kupplung montieren

⚠ Auch Stifte/Buchsen montieren, die nicht angeschlossen sind.

❗ Die Stifte/Buchsen sind nach dem Eindrücken in den Einsatz nicht mehr demontierbar.

1. Druckstück, Zugentlastung, Dichtung und Druckscheibe auf Kabel aufschieben.
2. Der Stift/die Buchse der Position 4 hat einen größeren Durchmesser. Diesen zuerst in seine Halterung stecken. Alle Stifte / Buchsen bis zum hörbaren Einrasten in die Sechskant-führung des Einsatzes drücken.
3. Isolierhülse auf Einsatz schieben.
4. Einsatz mit Führungsnase in die Führungs-nut der Hülse stecken (Fig.G).
5. Druckscheibe, Dichtung, Zug-entlastung montieren.
6. Druckstück (2) festschrauben (Drehmoment -> Technische Daten).
7. Arretierschraube festschrauben (Fig. H).

Connecting conductors to pins

⚠ The insulation of the conductor shall reach up to the pins. The conductor must not be damaged.

1. Strip off ca. 30 mm of cable insulation.(Fig.1)
2. Strip off ca. 8 mm of insulation from cable conductors.

Crimp plugs/contacts

1. Insert conductor into the connection opening of the plug/contact pin.
2. Crimp on all conductors using crimping tool (→ Accessories) [Fig.A]
   or
   solder all conductors to plug pins/ contact and pull shrink-on sleeve over each solder ring point.

Assembling plugs/coupler

⚠ Also assemble plug/coupler pins that are not connected.

❗ Once they have been pressed into the plug/coupler insert, the plug pins cannot be disassembled.

1. Push pressure piece, strain relief, seal and thrust washer on to cable.
2. The plug/contact pin, Item 4, is larger in diameter. To avoid mistakes, put this into the holder first. Push all the plug pins into the hexa gonal keyways of the plug/coupler insert until they engage.
3. Push the insulating sleeve on to the plug insert.
4. Insert the plug insert with guide lug into the keyway of the plug sleeve (Fig.G).
5. Fit thrust washer, seal and strain relief.
6. Screw pressure piece tight [torque -> Technical Data]
7. Tighten locking screw (Fig. H).

Raccordement des conducteurs aux contacts mâles/ femelles

⚠ L'isolation du conducteur doit arriver jusqu'aux contacts . Le conducteur ne doit pas être endommagé.

1. Dénuder le câble sur env. 30 mm.(Fig.1)
2. Dénuder les conducteurs du câble sur env. 8 mm.

Présertir Fiche/Prolongateur

1. Enficher le conducteur dans l'ouverture du contact mâle/femelle.
2. Pré-sertir tous les conducteurs avec la pince à sertir (→ accessoire) (Fig.A).
   ou
   braser tous les conducteurs avec les contacts mâles/femelles et enfiler la gaine thermorétractable sur chaque brasure.

Montage de la fiche/du prolongateur

⚠ Monter aussi les contacts mâles/ femelles non raccordés.

❗ Les contacts mâles/femelles ne peuvent plus être démontés après avoir été pressés dans le bloc de fiche.

1. Monter la pièce de pression, la décharge de tension.
2. Le contact mâle/femelle de la position 4 a un plus gros diamètre. Pour éviter toute confusion, enficher celui-ci en premier dans son support.
   Enfoncer tous les contacts mâlesfemelles jusqu'à l'enclenchement dans le guidage hexagonal du bloc de fiche.
3. Monter la douille isolante sur le bloc de fiche.
4. Engager le bloc de fiche avec l'ergot de guidage dans la rainure de guidage de la douille de fiche (Fig.G).
5. Monter la rondelle de pression, le joint, la décharge de tension.
6. Visser la pièce de pression (couple -> Caractéristiques techniques).
7. Visser la vis d'arrêt (Fig. H).

Handhabung

A/A1 Den Stecker mit der Führungsnase lagerichtig in die entsprechende Führungsnut der Kupplung bis zum 1. Anschlag einstecken **(B)**.

B1 Danach den Stecker um ca. 30° nach rechts bis zum Begrenzungsanschlag drehen.

C Stecker bis zum Endanschlag mit der Kupplung zusammenstecken.

D Überwurfmutter „handfest“ an der gesteckten Steckverbindung.

Handling

A/A1 Insert the plug into the coupler until they reach the 1st stop. Ensure that the position of the key on the plug corresponds to that of the keyway on the coupler **(B)**.

B1 Then turn the plug to the right through ca. 30° until it reaches the stop.

C Insert plug into coupler until it reaches the final stop.

D Tighten the coupling nut on the connected plug and socket.

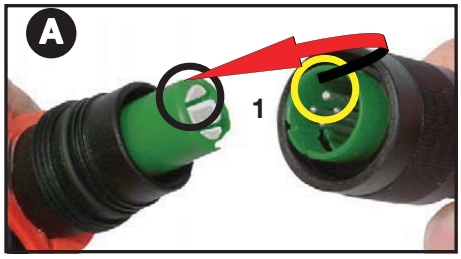
Manoeuvre

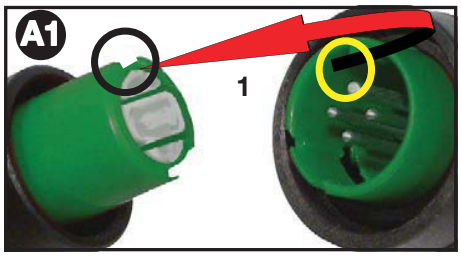
A/A1 Introduisez la fiche en positionnant correctement l’ergot de guidage dans la rainure de guidage correspondante du prolongateur jusqu’à la 1ère butée **(B)**.

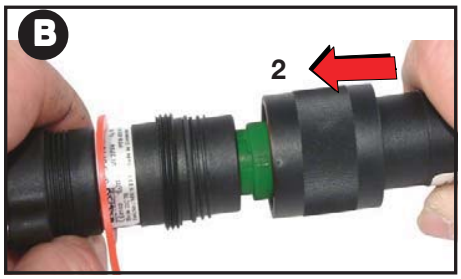
B 1 Ensuite, tournez la fiche d’environ 30° vers la droite jusqu’en butée de limitation.

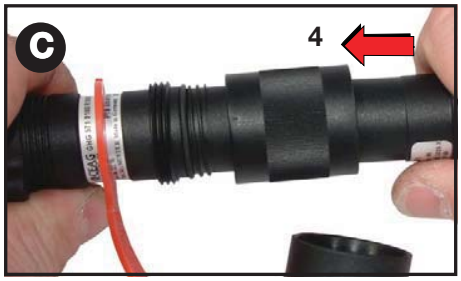
C Assemblez la fiche et le prolongateur jusqu’en butée.

D Vissez à fond la collerette de fixation sur le connecteur enfiché.









Normenkonformität

Das Steckverbindungssystem entspricht den in der Konformitätserklärung aufgeführten Normen und den vergleichbaren IEC Standards
IEC 60079-0, IEC 60079-1,
IEC 60079-7, IEC 61241-0,
IEC 61241-1.
CAN/CSA C22.2 E60079-0-02
CAN/CSA C22.2 E60079-1-02
CAN/CSA C22.2 E60079-7-2003
CAN/CSA C22.2 No 213
CAN/CSA C22.2 No 182.3 M1987
CAN/CSA C22.2 No 94.1-07
94/9 EG: Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen.
Das Steckverbindungssystem ist gemäß DIN EN ISO 9001 entwickelt, gefertigt und geprüft worden.

Conformity with standards

The plug and socket system is conform to the standards specified in the EC-Declaration of conformity and additional conform to the comparable IEC Standards
IEC 60079-0, IEC 60079-1,
IEC 60079-7, IEC 61241-0,
IEC 61241-1.
CAN/CSA C22.2 E60079-0-02
CAN/CSA C22.2 E60079-1-02
CAN/CSA C22.2 E60079-7-2003
CAN/CSA C22.2 No 213
CAN/CSA C22.2 No 182.3 M1987
CAN/CSA C22.2 No 94.1-07
94/9 EC: Equipment and protective systems intended for use in potentially explosive atmospheres.
It has been designed, manufactured and tested according to the state of the art and to
DIN EN ISO 9001.

Conformité avec les normes

Les boîtes à bornes sont conformes aux normes reprises dans la déclaration de conformité et supplémentaires conformes à la comparables aux IEC Standards
IEC 60079-0, IEC 60079-1, I
EC 60079-7, IEC 61241-0,
IEC 61241-1.
CAN/CSA C22.2 E60079-0-02
CAN/CSA C22.2 E60079-1-02
CAN/CSA C22.2 E60079-7-2003
CAN/CSA C22.2 No 213
CAN/CSA C22.2 No 182.3 M1987
CAN/CSA C22.2 No 94.1-07
94/9 CE: Appareils et systèmes de protection destinés à être utilisés en atmosphère explosible.
Les boîtes à bornes ont été conçues, fabriquées et contrôlées suivant DIN EN ISO 9001.

COOPER Crouse-Hinds

EG-Konformitätserklärung
EC-Declaration of conformity
CE-Déclaration de conformité
PTB 03 ATEX 1016 X

GHG 900 1000 P0010 D

Wir / we / nous

Cooper Crouse-Hinds GmbH
Neuer Weg-Nord 49
D-69412 Eberbach

erklären in alleiniger Verantwortung, dass die
hereby declare in our sole responsibility, that the
déclarons de notre seule responsabilité, que le

Mehrfachsteckverbindung eXLink 4-/5-polig
multiple plug and socket systems eXLink, 4-/5-pole
multiple fiches et prises eXlLink, à 4-/5-pôles

⟨Ex⟩ II 2 G Ex de IIC T6 // ⟨Ex⟩ II 2 G Ex ia/ib IIC T6
⟨Ex⟩ II 2 D Ex tD A21 IP66 T80°C

Typ GHG 57.

auf die sich diese Erklärung bezieht, mit den folgenden Normen oder normativen Dokumenten übereinstimmen.
which are the subject of this declaration, are in conformity with the following standards or normative documents.
auquel cette déclaration se rapporte, est conforme aux normes ou aux documents normatifs suivants.

Bestimmungen der Richtlinie Terms of the directive Prescription de la directive		Titel und / oder Nr. sowie Ausgabedatum der Norm. Title and / or No. and date of issue of the standard. Titre et / ou No. ainsi que date d'émission des normes.
94/9/EG:	Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen.	**EN 60 079-0: 2006** **EN 60 079-1: 2004** **EN 60 079-7: 2007** **EN 60 079-11: 2007**
94/9/EC:	Equipment and protective systems intended for use in potentially explosive atmospheres.	**EN 61 241-0: 2006** **EN 61 241-1: 2004** **EN 60 529: 1991 + A1: 2000**
94/9/CE:	Appareils et systèmes de protection destinés à être utilisés en atmosphère explosibles.	**EN 61 984: 2001** **EN 60 999-1: 2000**
2004/108 EG: *2004/108 EC:* *2004/108 CE:*	Elektromagnetische Verträglichkeit *Electromagnetic compatibility* *Compatibilité électromagnétique*	**EN 60 947-1: 2007**

Eberbach, den 04.07.2008

Ort und Datum *Place and date* *Lieu et date*	i.A. R. Brandel Leiter Labor *Head of Laboratory* *Chef du dépt. Laboratoire*	i.V. H. Huter Leiter Approbation *Head of Approval office* *Chef du dépt. approbation*

PTB 96 ATEX Q 1 - 4

Zertifizierungsstelle *Notified Body of the certification* *Organes Notifié et Compétent*	**Physikalisch-Technische Bundesanstalt (0102)** **Bundesallee 100** ***D-38116 Braunschweig***
Konformitätsbewertungsstelle *Notified Body to quality evaluation* Organes d'attestation de conformité	**Physikalisch-Technische Bundesanstalt (0102)** **Bundesallee 100** **D-38116 Braunschweig**

Für den Sicheren Betrieb des Betriebsmittels sind die Angaben der zugehörigen Betriebsanleitung zu beachten.
For the safe use of this apparatus, the informations given in the accompanying operating instructions must be followed.
Afin d'assurer le bon fonctionnement de nos appareils, priére de respecter les directives du mode d'emploi correspondent à ceux-ci.

CEAG

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eXLink 4-polig Gerätestecker, Flanschsteckdose/
4-pole Inlet, Flange/
4 la prise et le prolongateur

COOPER Crouse-Hinds

Technische Angaben

Gerätekennzeichnung nach 94/9/EG:	Ex II 2G Ex de IIC T6/ Ex II 2G Ex ia/ib IIC T6 Ex II 2D tD A21 IP66 T80°C
nach CSA	Class I, Zone 1 Ex de IIC T6 Class I, Div 2; Gr. A,B,C,D
Zulässige Umgebungs-temperatur:	-25°C/-55°C bis +40°C[1]
EG-Baumusterprüf-bescheinigung:	PTB 03 ATEX 1016 X
Bemessungsspannung:	bis 250 V, 50/60 Hz
Bemessungsstrom:	max. 10 A
Anschlussquerschnitt:	AWG 22, AWG 26
Anschlussleitung:	AWG 22/26 Metrofunk
Vibrationsfestigkeit nach EN 60068-2-6 10-150 Hz:	2g / 30 min[2]
Prüfdrehmomente Arretierungsschraube:	1,0 Nm
Einschraubgewinde Steck-dose, Gerätestecker:	30 Nm
Überwurfmutter:	2,5 Nm (handfest)

1) die besonderen Bedingungen gemäß Prüfschein PTB 03 ATEX 1016 X sind zu beachten.
2) Die Hinweise im Kapitel „Montage“ beachten!

Technical Data

Apparatus marking acc. to 94/9/EC:	Ex II 2G Ex de IIC T6/ Ex II 2G Ex ia/ib IIC T6 Ex II 2D tD A21 IP66 T80°C
acc. CSA	Class I, Zone 1 Ex de IIC T6 Class I, Div 2; Gr. A,B,C,D
Permissible ambient temperature:	-25°C/-55°C to +40 °C[1]
EC type examination certificate:	PTB 03 ATEX 1016 X
Rated voltage:	up to 250 V, 50/60 Hz
Rated current:	max. 10 A
Terminal cross section:	AWG 22, AWG 26
Cable:	AWG 22/26 Metrofunk
Vibration resistance acc. EN 60068-2-6 10-150 Hz:	2g / 30 min[2]
Test torques Locking screw:	1.0 Nm
Screw-in thread - flange socket, inlet:	30 Nm
coupling nut:	2,5 Nm (by hand)

1) observe special requirements accd. certifcation PTB 03 ATEX 1016 X.
2) Follow the instructions in the chapter ´Installation!

Caractéristiques techniques

Marquage de l’appareil selon 94/9/CE:	Ex II 2G Ex de IIC T6/ Ex II 2G Ex ia/ib IIC T6 Ex II 2D tD A21 IP66 T80°C
en fonction de CSA	Class I, Zone 1 Ex de IIC T6 Class I, Div 2; Gr. A,B,C,D
Température ambiante admissible:	-25°C/-55°C à +40°C[1]
Attestation d’examen CE de type:	PTB 03 ATEX 1016 X
Tension nominale:	jusqu’à 250 V, 50/60 Hz
Courant nominal:	max. 10 A
Section raccordement:	AWG 22, AWG 26
Cable:	AWG 22/26 Metrofunk
Résistance aux vibrations selon EN 60068-2-6 10-150 Hz:	2g / 30 min[2]
Couples de serrage testés Vis d´ arrêt:	1,0 Nm
Filets de vis de prise à pride, connecteur:	30 Nm
Ecrou(Bien serrer à la main):	2,5 Nm

1) Respecter les précautions particulières selon l'attestation d'examen CE de type PTB 03 ATEX 1016 X
2) Suivre les instructions du chapitre ´Montage!

Sicherheitshinweise

Vor dem Öffnen der Druckschraube am Stecker und Kupplung, ist die Spannungsfreiheit sicherzustellen.

Die Montageanleitung darf nur zusammen mit der ausführlichen Betriebsanleitung „GHG5707001P0001“ (unter www.ceag.de erhältlich) verwendet werden.

Die Benutzerinformationen für „MOOG-Ventile“ sind zu beachten (www.Moog.com/industrial).

Das Konfektionieren der Steckverbinder darf nur durch Fachkräfte erfolgen.

Die Gewindebohrungen im druckfesten Schutzgehäuse oder Einbaugeräten, müssen den Mindestanforderungen der EN 60079-1, entsprechen.

Die Steckverbindungen eXLink sind nicht für den Einsatz in der Zone 0 oder 20 geeignet.

Zur Sicherstellung des Explosionsschutzes dürfen in die Bohrungen von druckfesten Gehäusen nur Gerätestecker und Flanschsteckdosen aus Metall eingesetzt werden. Gerätestecker und Flanschsteckdosen aus Metall sind durch geeignete Maßnahmen in das Erdpotential der Gehäuse bzw. Geräte mit einzubeziehen.

Steckverbindung nur in technisch einwandfreiem Zustand sowie bestimmungsgemäß, sicherheits- und gefahrenbewusst unter Beachtung dieser Montage- und Betriebsanleitung montieren und betreiben.

Die unter Spannung stehenden Steckverbindungskomponenten müssen sofort nach dem Trennen mit der Schutzkappe verschlossen werden, damit die Schutzart und damit der Explosionsschutz sichergestellt wird.

Safety instructions

Before opening the pressure screw on the plug and coupler, ensure that it has been isolated from the supply.

The assembly instructions must be used in conjunction with the detailed operating instructions “GHG5707001P0001” (available from www.ceag.de).

The user information for „MOOG-Ventile“ must to be observed. (www.Moog.com/industrial).

The connection of plug and socket systems shall only be carried out by qualified personnel.

The threaded holes in the flameproof enclosure shall fulfil the minimum requirements of EN 60079-1.

Plug and socket systems of the type eXLink are not suited for use in zone 0 or 20 areas.

In order to guarantee the explosion protection, only inlets and flange sockets made of metal may be fitted in the boreholes of flameproof enclosures. The metal flang sockets and inlets shall be incorporated in the earth potential eyualization.

They shall be used for their intended purpose and shall be in an undamaged and perfect state.

When opened, the live plug and socket system components shall be sealed immediately after disconnection using the protective cap.

Here it is necessary to ensure that it is closed correctly, otherwise the minimum degree of protection and the explosion protection are no longer guaranteed.

Instructions de sécurité

Avant de relâcher la vis de pression sur la prise et le prolongateur, vérifiez l’absence de tension.

Utilisez la notice de montage uniquement en association avec les instructions détaillées de service “GHG5707001P0001” (disponibles sur le site www.ceag.de).

Les informations utilisateur pour les „MOOG-Ventile“ doivent être respectées. (www.Moog.com/industrial).

Seul un personnel qualifié est autorisé à effectuer le branchement électrique des connecteurs mâles-femelles.

Les alésages filetés du boîtier de protection ou appareil à encastrer résistant à la pression doivent satisfaire aux exigences minima de la norme EN 60079-1.

Les connecteurs mâles-femelles eXLink ne conviennent pas pour une utilisation en zone 0 et 20.

Afin de garantir une protection antidéflagrante, seuls des socles connecteurs et des prises de courant à bride métalliques doivent être montés dans les évidements des boîtiers à l’épreuve de la pression. Les prises à bride aux métal et les sockles connecteur aux métal doivent être reliés au même potentiel.

N’utilisez les prises de courant à bride et socles connecteurs qu’avec les fiches et prolongateurs correspondants et en parfait état.

Après déconnexion, les éléments de connexion encore sous tension doivent immédiatement être protégés à l’aide d’obturateurs.

GHG 570 7001 P0102 (F)/Auflage in tsd./38.11/Str.

Handhabung

A/A1 Den Stecker mit der Führungsnase lagerichtig in die entsprechende Führungsnut der Kupplung bis zum 1. Anschlag einstecken **(B)**.

B1 Danach den Stecker um ca. 30° nach rechts bis zum Begrenzungsanschlag drehen.

C Stecker bis zum Endanschlag mit der Kupplung zusammenstecken.

D Die Überwurfmutter des Steckers über die Kupplung schieben und handfest festschrauben.

Handling

A/A1 Insert the plug into the coupler until they reach the 1st stop. Ensure that the position of the key on the plug corresponds to that of the keyway on the coupler **(B)**.

B1 Then turn the plug to the right through ca. 30° until it reaches the stop.

C Insert plug into coupler until it reaches the final stop.

D Slide the coupling nut of the plug over the coupler and tighten well by hand

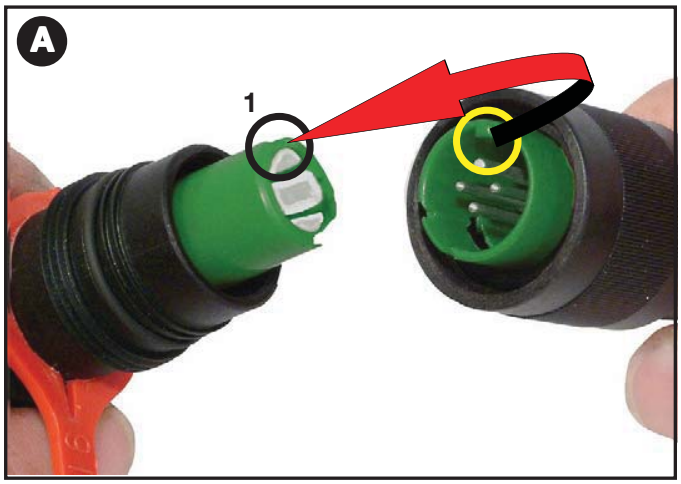
Manoeuvre

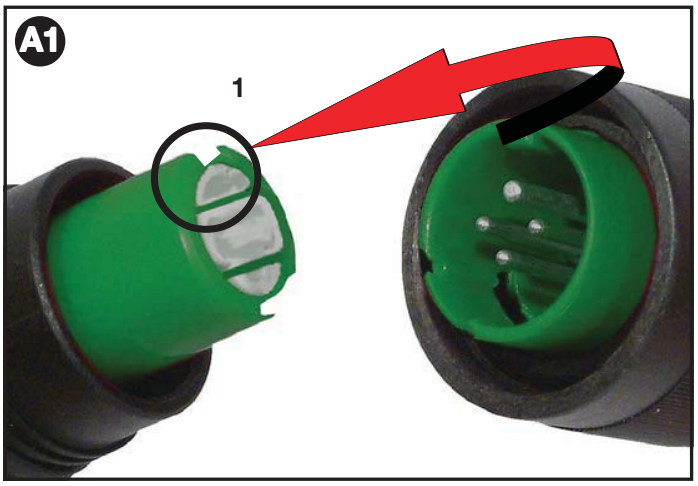
A/A1 Introduisez la fiche en positionnant correctement l'ergot de guidage dans la rainure de guidage correspondante du prolongateur jusqu'à la 1ère butée **(B)**.

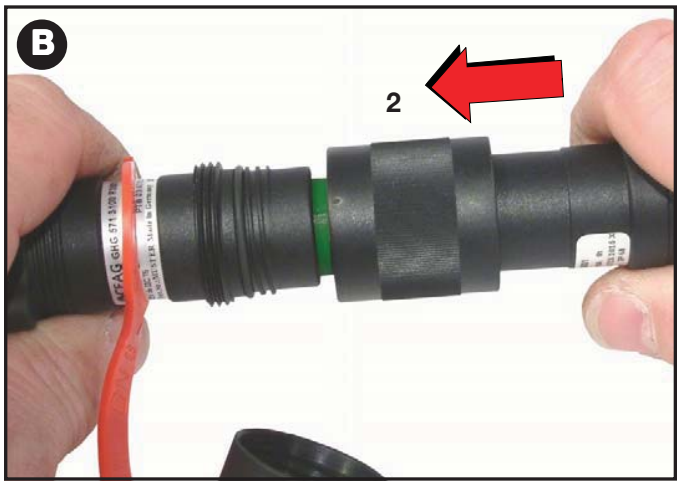
B 1 Ensuite, tournez la fiche d'environ 30° vers la droite jusqu'en butée de limitation.

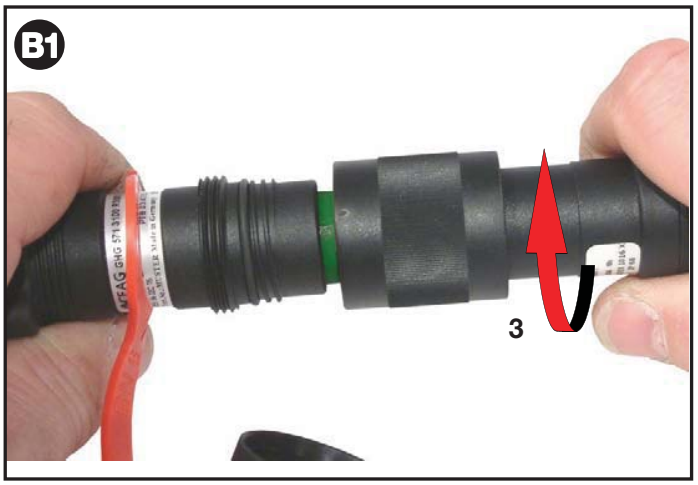
C Assemblez la fiche et le prolongateur jusqu'en butée.

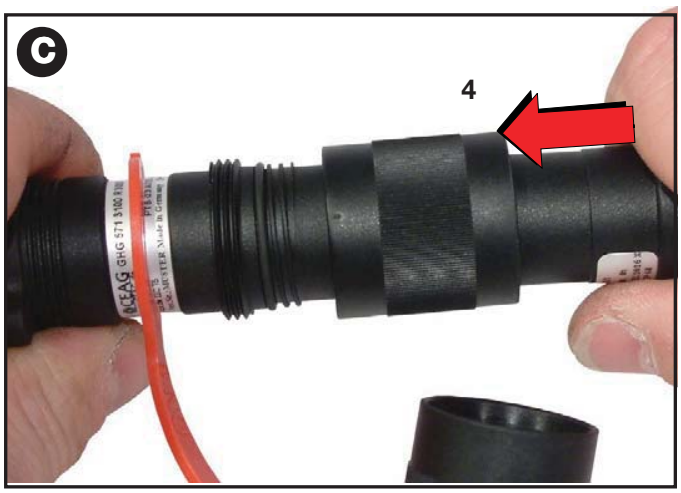
D Enfiler l'écrou de la prise sur le prolongateur et bien serrer à la main.

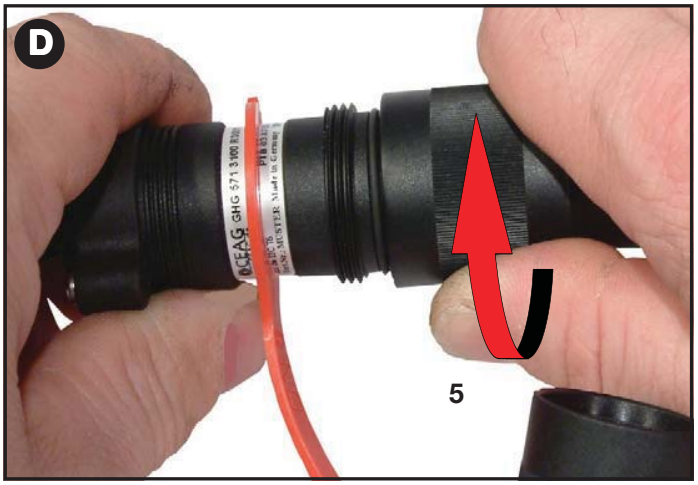






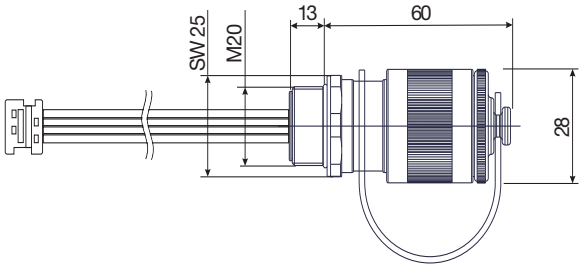




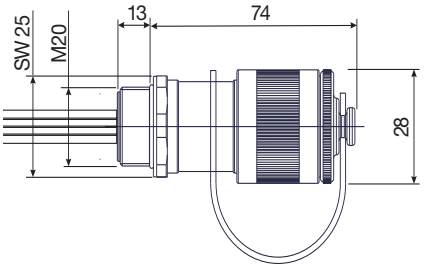


Montage / Mounting / Montage

Gerätestecker mit Anschlussleitung
Inlet with connection leads
Socle connecteuravec lignes de raccordement



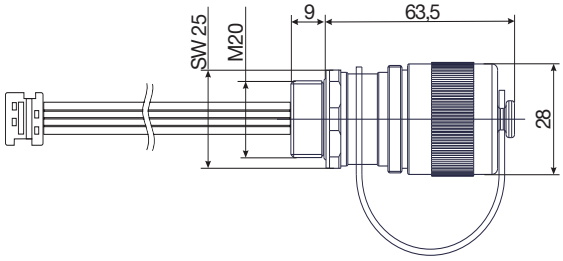
6 h



V < 2000 cm³

V > 2000 cm³

Flanschsteckdose mit Anschlussleitung
Flange socket with connection leads
Prise à bride avec lignes de raccordement



1 h

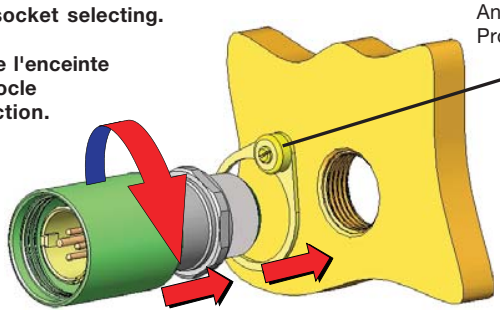
5 h

10 h

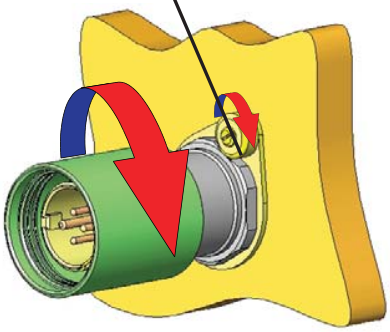
Das Gehäusevolumen bei der Auswahl des Gerätesteckers berücksichtigen.

Observe the flameproof enclosure volume when flange-socket selecting.

Observez le volume de l'enceinte antidéflagrante lors socle connecteuravec sélection.



Verdrehungsschutz - optional
Anti-torsion protection - optionally
Protection anti-torsion - facultatifement



Flanschsteckdosen, oder Gerätestecker müssen durch geeignete Maßnahmen (z.B. Einkleben, Kontern (Prüfdrehmoment 30 Nm) oder Arretieren mit einem Verdrehungsschutz gegen Verdrehen oder Selbstlockern gesichert werden.

Suitable measures shall be applied (e.g. adhesive, locking (Test torques 30 Nm) and retaining with anti-torsion protection) to safeguard screwed-in flange sockets, inlets or angle pieces against twisting or self-loosening.

Une fois vissés, les prises à brides ou socles connecteurs doivent être bloqués par un moyen approprié (par ex. collage, contre-écrou (Couples de serrage testés 30 Nm) et blocage par protection anti-torsion) pour les empêcher de tourner ou de se dévisser.

Normenkonformität

Das Steckverbindungssystem entspricht den in der Konformitätserklärung aufgeführten Normen und den vergleichbaren IEC Standards
IEC 60079-0, IEC 60079-1, IEC 60079-7,
IEC 61241-0, IEC 61241-1.
CAN/CSA C22.2 E60079-0-02
CAN/CSA C22.2 E60079-1-02
CAN/CSA C22.2 E60079-7-2003
CAN/CSA C22.2 No 213
CAN/CSA C22.2 No 182.3 M1987
CAN/CSA C22.2 No 94.1-07
94/9 EG: Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen.
Das Steckverbindungssystem ist gemäß DIN EN ISO 9001 entwickelt, gefertigt und geprüft worden.

Conformity with standards

The plug and socket system is conform to the standards specified in the EC-Declaration of conformity and additional conform to the comparable IEC Standards
IEC 60079-0, IEC 60079-1, IEC 60079-7,
IEC 61241-0, IEC 61241-1.
CAN/CSA C22.2 E60079-0-02
CAN/CSA C22.2 E60079-1-02
CAN/CSA C22.2 E60079-7-2003
CAN/CSA C22.2 No 213
CAN/CSA C22.2 No 182.3 M1987
CAN/CSA C22.2 No 94.1-07
94/9 EC: Equipment and protective systems intended for use in potentially explosive atmospheres.
It has been designed, manufactured and tested according to the state of the art and to DIN EN ISO 9001.

Conformité avec les normes

Les boîtes à bornes sont conformes aux normes reprises dans la déclaration de conformité et supplémentaires conformes à la comparables aux IEC Standards
IEC 60079-0, IEC 60079-1, IEC 60079-7,
IEC 61241-0, IEC 61241-1.
CAN/CSA C22.2 E60079-0-02
CAN/CSA C22.2 E60079-1-02
CAN/CSA C22.2 E60079-7-2003
CAN/CSA C22.2 No 213
CAN/CSA C22.2 No 182.3 M1987
CAN/CSA C22.2 No 94.1-07
94/9 CE: Appareils et systèmes de protection destinés à être utilisés en atmosphère explosible.
Les boîtes à bornes ont été conçues, fabriquées et contrôlées suivant DIN EN ISO 9001.

COOPER Crouse-Hinds

EG-Konformitätserklärung
EC-Declaration of conformity
CE-Déclaration de conformité
PTB 03 ATEX 1016 X

GHG 900 1000 P0010 D

Wir / we / nous

Cooper Crouse-Hinds GmbH
Neuer Weg-Nord 49
D-69412 Eberbach

erklären in alleiniger Verantwortung, dass die
hereby declare in our sole responsibility, that the
déclarons de notre seule responsabilité, que le

Mehrfachsteckverbindung eXLink 4-/5-polig
multiple plug and socket systems eXLink, 4-/5-pole
multiple fiches et prises eXLink, à 4-/5-pôles

Typ GHG 57.

⟨Ex⟩ II 2 G Ex de IIC T6 // ⟨Ex⟩ II 2 G Ex ia/ib IIC T6
⟨Ex⟩ II 2 D Ex tD A21 IP66 T80°C

auf die sich diese Erklärung bezieht, mit den folgenden Normen oder normativen Dokumenten übereinstimmen.
which are the subject of this declaration, are in conformity with the following standards or normative documents.
auquel cette déclaration se rapporte, est conforme aux normes ou aux documents normatifs suivants.

Bestimmungen der Richtlinie Terms of the directive Prescription de la directive		Titel und / oder Nr. sowie Ausgabedatum der Norm. Title and / or No. and date of issue of the standard. Titre et / ou No. ainsi que date d'émission des normes.
94/9/EG:	Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen.	**EN 60 079-0: 2006** **EN 60 079-1: 2004** **EN 60 079-7: 2007** **EN 60 079-11: 2007** **EN 61 241-0: 2006** **EN 61 241-1: 2004** **EN 60 529: 1991 + A1: 2000**
94/9/EC:	Equipment and protective systems intended for use in potentially explosive atmospheres.	
94/9/CE:	Appareils et systèmes de protection destinés à être utilisés en atmosphère explosibles.	**EN 61 984: 2001** **EN 60 999-1: 2000**
2004/108 EG: *2004/108 EC:* *2004/108 CE:*	Elektromagnetische Verträglichkeit *Electromagnetic compatibility* *Compatibilité électromagnétique*	**EN 60 947-1: 2007**

Eberbach, den 04.07.2008

Ort und Datum
Place and date
Lieu et date

i.A. R. Brandel
Leiter Labor
Head of Laboratory
Chef du dépt. Laboratoire

i.V. H. Huter
Leiter Approbation
Head of Approval office
Chef du dépt. approbation

PTB 96 ATEX Q 1 - 4

Zertifizierungsstelle
Notified Body of the certification
Organes Notifié et Compétent

Physikalisch-Technische Bundesanstalt (0102)
Bundesallee 100
D-38116 Braunschweig

Konformitätsbewertungsstelle
Notified Body to quality evaluation
Organes d'attestation de conformité

Physikalisch-Technische Bundesanstalt (0102)
Bundesallee 100
D-38116 Braunschweig

Für den Sicheren Betrieb des Betriebsmittels sind die Angaben der zugehörigen Betriebsanleitung zu beachten.
For the safe use of this apparatus, the informations given in the accompanying operating instructions must be followed.
Afin d'assurer le bon fonctionnement de nos appareils, prière de respecter les directives du mode d'emploi correspondent à ceux-ci.

CEAG

Cooper Crouse-Hinds GmbH
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D-69412 Eberbach
Phone +49 (0) 6271/806-500
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Internet: www.CEAG.de
E-Mail: info-ex@ceag.de

eXLink 6+1-polig Stecker, Kupplung/
6+1-pole plug, coupler /
6+1 la fiche, prolongateur

COOPER Crouse-Hinds

Technische Angaben

Gerätekennzeichnung nach 94/9/EG:	Ex II 2 G Ex de IIC T6 Ex II 2 G Ex ia/ib IIC T6
nach CSA	Class I, Zone 1 Ex de IIC T6 Class I, Div 2; Gr. A,B,C,D
EG-Baumusterprüf-bescheinigung:	PTB 06 ATEX 1031 X
Zulässige Umgebungs-temperatur:	-25°C/-55°C bis 40°C[1)]
Bemessungsspannung:	bis 400 V, 50/60 Hz
Bemessungsstrom:	max. 16 A
Leitungseinführung ø:	Standard Optional
Stecker, Kupplung	ø7-11mm ø11-15mm
Anschlussleitung:	LEONI 7x0,75mm², MUD
Anschlussquerschnitt:	1x0,75-1,5mm²/ 2,5mm²
Vibrationsfestigkeit nach EN 60068-2-6 10-150 Hz:	2g / 30 min[2)]
Prüfdrehmomente:	Metall
Arretierungsschraube	1,0 Nm
Einschraubgewinde Steck-dose, Gerätestecker	3,5 Nm
Druckschraube	3,5 Nm
Druckschraube	3,5 Nm

1) die besonderen Bedingungen gemäß Prüfschein PTB 03 ATEX 1016 X sind zu beachten.
2) Die Hinweise im Kapitel „Montage“ beachten!

Technical Data

Apparatus marking acc. to 94/9/EC:	Ex II 2 G Ex de IIC T6 Ex II 2 G Ex ia/ib IIC T6
acc. CSA	Class I, Zone 1 Ex de IIC T6 Class I, Div 2; Gr. A,B,C,D
EC type examination certificate:	PTB 06 ATEX 1031 X
Permissible ambient temperature:	-25°C/-55°C to +40 °C[1)]
Rated voltage:	up to 400 V, 50/60 Hz
Rated current:	max. 16 A
Cable entry ø:	Standard Optional
Plug, coupler	ø7-11mm ø11-15mm
Cable:	LEONI 7x0,75mm², MUD
Terminal cross section:	1x0,75-1,5mm²/ 2,5mm²
Vibration resistance acc. EN 60068-2-6 10-150 Hz:	2g / 30 min[2)]
Test torques:	
Locking screw	1.0 Nm
Screw-in thread - flange socket, inlet	3.5 Nm
Pressure screw	3.5 Nm
Pressure screw	3.5 Nm

1) observe special requirements accd. certifcation PTB 03 ATEX 1016 X.
2) Follow the instructions in the chapter ´Installation

Caractéristiques techniques

Marquage de l’appareil selon 94/9/CE:	Ex II 2 G Ex de IIC T6 Ex II 2 G Ex ia/ib IIC T6
en fonction de CSA	Class I, Zone 1 Ex de IIC T6 Class I, Div 2; Gr. A,B,C,D
Attestation d’examen CE de type:	PTB 06 ATEX 1031 X
Température ambiante admissible:	-25°C/-55°C à +40°C[1)]
Tension nominale:	jusqu’à 400 V, 50/60 Hz
Courant nominal:	max. 16 A
Entrée de câble ø:	Standard Optional
Fiche, Prolongateur	ø7-11mm ø11-15mm
Cable:	LEONI 7x0,75mm², MUD
Section raccordement:	1x0,75-1,5mm²/ 2,5mm²
Résistance aux vibrations selon EN 60068-2-6 10-150 Hz:	2g / 30 min[2)]
Couples de serrage testés:	
Vis d´arrêt	1,0 Nm
Filets de vis de prise à pride, connecteur	3,5 Nm
Vis de serrage	3,5 Nm
Vis de serrage	3,5 Nm

1) Respecter les précautions particulières selon l'attestation d'examen CE de type PTB 03 ATEX 1016 X
2) Suivre les instructions du chapitre ´Montage!

Sicherheitshinweise

Zielgruppen dieser Anleitung sind Elektrofachkräfte und unterwiesene Personen in Anlehnung an die IEC 60079-14.

Die Montageanleitung nur zusammen mit der ausführlichen Betriebsanleitung „GHG5707005P0001“ (unter www.ceag.de erhältlich) verwenden.
Die Benutzerinformationen für „MOOG-Ventile“ sind zu beachten (www.Moog.com/industrial).

Die auf den Geräten angegebene Temperaturklasse und Zündschutzart ist zu beachten.

Die Steckverbindung ist nicht für den Einsatz im explosionsgefährdeten Bereich der Zone 0 und Zone 20, 21, 22 gemäß EN 60079-10 geeignet.

Steckverbinder unter Last nur mit den Werten der Technischen Daten betreiben.

Trennen unter Belastung maximal bis 230 V / 400 V , 10 A möglich.

Steckverbindung nur in technisch einwandfreiem Zustand sowie bestimmungs-gemäß, sicherheits- und gefahrenbewusst unter Beachtung dieser Montage- und Betriebsanleitung montieren und betreiben.

Beachten Sie die nationalen Sicherheits- und Unfallverhütungsvorschriften und die nachfolgenden Sicherheitshinweise in dieser Betriebsanleitung, die wie dieser Text in Kursivschrift gefasst sind!

Safety instructions

Operations shall be carried out by electricians and suitably personnel trained in hazardous area with knowledge of increased safety explosion protection in accordance with IEC 60079-14.

The assembly instructions must be used in conjunction with the detailed operating instructions “GHG5707005P0001” (available from www.ceag.de).
The user information for „MOOG-Ventile“ must to be observed (www.Moog.com/industrial).

The temperature class and explosion group marked on the terminal boxes have to be observed.

The plug and socket system is not suitable for Zone 0 and tone 20, 21, 22 hazardous areas accordance with IEC 60079-10.

The plug and socket system may only be connected or disconnected under load acc. to technical data. (230 V / 400 V max. 10 A)

These assembly and operating instructions shall be observed when installing and operating the plug and socket connector system. It shall only be used in a technically perfect state and in accordance with the intended purpose while paying attention to the particular safety and hazard aspects.

The national safety rules and regulations for the prevention of accidents, as well as the safety instructions included in these operating instructions, that, like this text, are set in italics, shall be observed!

Consignes de sécurité

Ce mode d’emploi s’adresse aux électriciens et personnes initiées sur base de la norme CEI 60079-14.

Utilisez la notice de montage uniquement en association avec les instructions détaillées de service “GHG5707005P0001” (disponibles sur le site www.ceag.de).
Les informations utilisateur pour les „MOOG-Ventile“ doivent être respectées (www.Moog.com/industrial).

Le groupe d’explosion et la classe de température marqués sur les appareils devront être respectés.

Le connecteur n’est pas conçu pour être utilisé dans les atmosphères explosibles des zones 0 et 20, 21, 22 conformément à CEI 60079-10.

Respecter impérativement les valeurs indiquées dans les caractéristiques techniques pour les connecteurs sous charge. Ne séparer qu'à 230 V / 400 V 10 A

Monter et utiliser le connecteur seulement s’il présente un état technique parfait, conformément à sa destination, en étant conscient des risques et des mesures de sécurité à appliquer dans le respect d es présentes instructions de montage et de service.

Tenir compte des prescriptions nationales en matière de sécurité et de prévention des accidents ainsi que des consignes de sécurité indiquées dans ce mode d’emploi, écrites en italiques comme ce texte !

GHG 570 7005 P0101 D/E/F (a)/Auflage/38.11/Str.

Fig. A

Fig. B

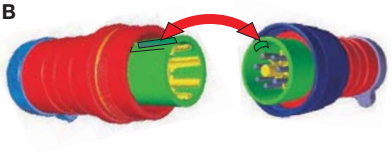


Fig. C

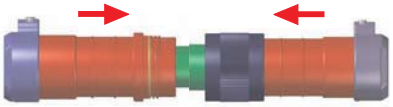


Fig. D

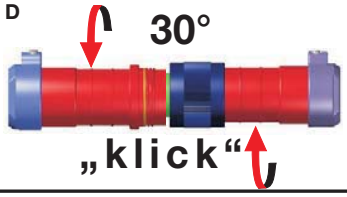
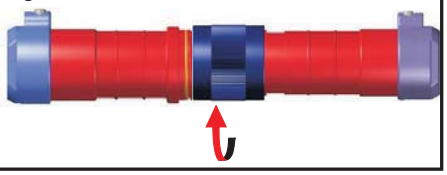


Fig. E

Fig. F



Verwendung/Eigenschaften

Die auf den Steckverbindern angegebene Temperaturklasse und Zündschutzart beachten.

Steckverbindung unter Last nur mit den Werten der Technischen Daten betreiben und trennen.

Die Verantwortung hinsichtlich bestimmungsgemäßer Verwendung der Steckverbindung unter Bezugnahme der in dieser Montage- und Betriebsanleitung vorhandenen Rahmenbedingungen (Technischen Daten) liegt allein beim Betreiber.
Keine Veränderungen bzw. Umbauten an der Steckverbindung vornehmen.
Jede andere Verwendung ist nicht bestimmungsgemäß.
COOPER Crouse-Hinds übernimmt keine Haftung für Schäden, die aus nicht bestimmungsgemäßer Verwendung entstehen.

Steckverbindung stecken/trennen

⚠ Die Flanschsteckdosen und Gerätestecker nur mit den zugehörigen unbeschädigten Steckern und Kupplungen betreiben.

⚠ Auf gleiche Codierung (Uhrzeit) der Steckverbindung achten.

i Der Winkel zwischen Führungsnase und PE Stift (mit größerem Durchmesser) ergibt die Uhrzeit. (Fig. A)

Steckverbindung stecken

1. Der Stecker bzw. Gerätestecker mit der Führungsnase lagerichtig in die entsprechende Führungsnute der Kupplung bzw. Flanschsteckdose stecken. (Fig. B)
2. Bis zum 1. Anschlag zusammenstecken.(Fig. C)
3. Stecker bzw. Gerätestecker gegen Kupplung bzw. Flanschsteckdose ca. 30° gegeneinander bis zum Anschlag verdrehen. (Fig. D)
4. Steckverbindung vollständig zusammenstecken.(Fig. E)

i Die elektrische Verbindung des Stecksystems ist jetzt hergestellt.
5. Überwurfmutter des Steckers andrücken und festschrauben.

! *IP Schutz und die mechanische Verbindung hergestellt.*(Fig. F)

Steckverbindung trennen

1. Steckverbindung in umgekehrter Reihenfolge zum Stecken trennen.

⚠ Bei nicht korrektem Stecken der Steckverbindungskomponenten ist der Explosionsschutz nicht mehr gewährleistet.

Use / Properties

The temperature class and type of protection stated on the apparatus shall be observed.

The plug and socket system may only be operated and disconnected under load acc. to the technical data.

The sole responsibility with respect to the suitability and proper use of the plug and socket systems with regard to the basic requirements of these instructions (see Technical Data) lies with the operator.
Plug and socket systems shall be checked in accordance with Section 6 of the named instructions, before being put into use.
Modifications or changes to the design of the plug and socket systems are not permitted.
Applications other than described are not permitted without COOPER CROUSE-HINDS´s prior written consent.
CCH takes no responsibility for damages causedby incorrect use.

Connection/disconnection of plug and socket

⚠ The flange sockets and inlets shall only be operated with the associated, undamaged plugs and couplers.

⚠ Attention shall be paid that the coding (time setting) of the plugs and sockets is the same.

i The time of day is the angle between the guide lug and the PE pin (larger in diameter). (Fig. A)

Connecting plug and socket

1. Insert the plug or inlet with the guide lug in the correct position into the respective keyway of the coupler or flange socket.(Fig. B)
2. Insert until 1st stop is reached.(Fig. C)
3. Turn plug or inlet through ca. 30° in relation to the coupler or flange socket until the stop is reached.(Fig. D)
4. Join plug and socket completely.(Fig. E)

i The electrical connection has now been made.
5. Press the coupling nut of the plug on and screw it tight.

! The IP degree of protection and the mechanical connection are established by tightening the coupling nut.(Fig. F)

Disconnecting plug and socket

1. To disconnect plug and socket, carry out the above actions in the reverse order.

⚠ When opened, the live plug and socket system components shall be sealed immediately after disconnection using the protective cap.

Utilisation / Propriétés

Observez la classe de température et le type de protection indiqués sur les appareils.

Respecter impérativement les valeurs indiquées dans les caractéristiques techniques lors de l'utilisation et du débranchement du connecteur.

En cas d'utilisation non conforme de ce dispositif de connexion, par référence aux conditions de base du présent mode d'emploi (caractéristiques techniques), l'exploitant en supporterait seul la responsabilité.

Contrôler le connecteur avant la mise en service conformément aux instructions mentionnées dans la section 6.

Ne pas modifier ou transformer le connecteur.

Utiliser exclusivement des pièces d'origine du fabricant pour les remplacements et réparations.

Toute autre utilisation s'avère non conforme.
COOPER Crouse Hinds décline toute responsabilité pour des dommag

Branchement/Débranchement du connecteur

⚠ N'utiliser les prises de courant à bride et les socles connecteurs qu'avec des fiches et prolongateurs compatibles intacts.

⚠ Veiller à un codage identique (heure) du connecteur.

i L'angle entre l'ergot de guidage et le contact mâle PE (d'un plus grand diamètre) donne l'heure. (Fig. A)

Branchement du connecteur

1. Engager dans la bonne position la fiche/le socle connecteur avec l'ergot de guidage dans la rainure de guidage correspondante du prolongateur/de la prise de courant à bride**.** (Fig. B)
2. Brancher les deux éléments jusqu'à la butée 1
3. Tourner dans des sens contraires, d'env. 30°, la fiche/le socle connecteur et le prolongateur/la prise de courant à bride jusqu'en butée.(Fig. D)
4. Le connecteur mâle-femelle boucher tout à fait. (Fig. E)

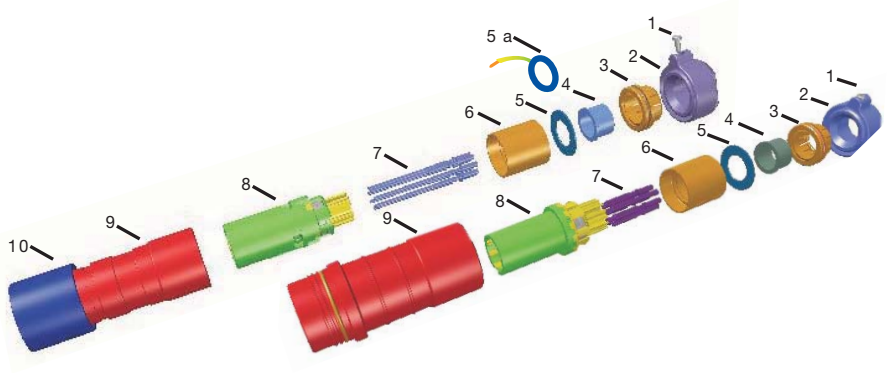
i Le branchement électrique du système de connexion est maintenant réalisé.
5. Appuyer l'écrou-raccord de la fiche et le visser.

! Le vissage de l'écrou-raccord a pour effet d'établir la protection IP et la liaison mécanique.(Fig. F)

Débranchement du connecteur

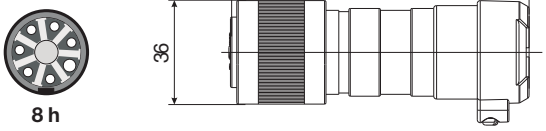
1. Débrancher le connecteur dans l'ordre inverse du branchement.

⚠ Les éléments de connexion conducteurs de tension à l'état ouvert doivent être fermés avec le capuchon dès le débranchement .

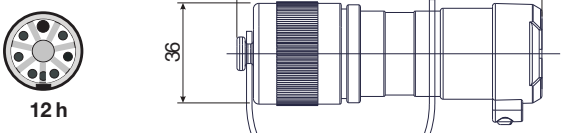


1	Arretierschraube	1	Locking screw	1	Vis d'arrêt
2	Druckstück	2	Pressure piece	2	Pièce de pression
3	Zugentlastung	3	Strain relief	3	Décharge de tension
4	Dichtung	4	Seal	4	Joint
5	Druckscheibe	5	Thrust washer	5	Rondelle de pression
5a	Druckscheibe mt PE	5a	Thrust washer with PE	5a	Rondelle de pression avec un pe
6	geteilte Isolierhülse	6	Insulating sleeve divisible	6	Douille isolante
7	Stift / Buchse	7	Plug pins / contact sockets	7	Contact mâle/femelle
8	Einsatz	8	Plug/Coupler insert	8	Bloc de fiche/prolongateur à insérer
9	Hülse	9	Plug/Coupler sleeve	9	Douille de fiche/prolongateur
10	Überwurfmutter	10	Coupling nut	10	Ecrou-raccord

Kupplung
Coupler
Prolongateur



Stecker
Plug
Fiche



Stecker/Kupplung öffnen

1. Eventuell vorhandene Schutzkappe abschrauben.
2. Arretierschraube (1) lösen.
3. Druckstück (2) aus Hülse (9) herausdrehen.
4. Einsatz (8) von vorne aus der Hülse (9) herausdrücken.
5. Dabei Zugentlastung (3), Dichtung (4), Druckscheibe (5), Isolierhülse (6) aus Hülse (9) nach hinten heraus nehmen.
6. Farbring zur Kennzeichnung auf Hülse (9) aufziehen.

Plug open (Fig. 7.1)

1. Screw down possible excisting protective cap. .
2. Loosen locking screw (1).
3. Screw out pressure piece (2) of plug sleeve (9).
4. Press out from front plug insert (8) out of plug sleeve (9).
5. At the same time, remove the strain relief (3), seal (4), thrust washer (5) and insulating sleeve (6) from the plug sleeve (9) from the back.
6. Fit coloured ring used for marking on to the plug sleeve (9).

Ouverture de la fiche

1. Dévisser le capuchon (si monté) de la fiche.
2. Dévisser la vis d'arrêt (1).
3. Sortir en la tournant la pièce de pression (2) de la douille de fiche (9).
4. Extraire par l'avant le bloc de fiche (8) de la douille de fiche (9).
5. Retirer pendant cette opération par l'arrière la décharge de tension (3), le joint (4), la rondelle de pression (5), la douille isolante (6) de la douille de fiche (9).
6. Monter la bague en couleur comme repère sur la douille de fiche (9).

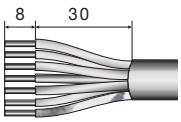


Fig. 1 abisolieren

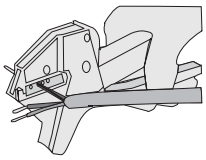


Fig. 2 crimpen

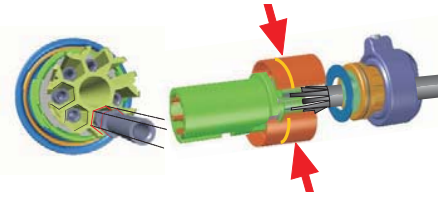


Fig. 3 einsetzen Fig. 4 zusammensetzen

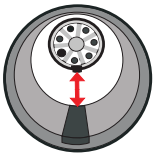


Fig. 5 Einsatz in Hülse

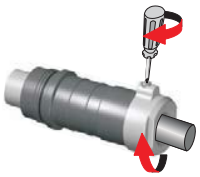


Fig. 6 festschrauben

Leiter mit Stiften / Buchsen verbinden

⚠ ***Die Isolation des Leiters muss bis an die Stifte / Buchsen heranreichen. Der Leiter und die Isolation dürfen nicht beschädigt sein.***

1. Kabel ca. 30 mm abmanteln.(Fig.1)
2. Leiter des Kabels ca. 8 mm abisolieren.

Stifte / Buchsen anschließen

1. Leiter in die Anschlussöffnung der Stifte / Buchsen (7) stecken.
2. Alle Leiter mit der Crimpzange (→ Zubehör) ancrimpen (Fig.2).
   oder
   Alle Leiter mit Stiften/Buchsen verlöten und Schrumpfschlauch über jede Lötstelle ziehen.

Stecker/Kupplung montieren

⚠ ***Auch Stifte/Buchsen montieren, die nicht angeschlossen sind.***

❗ *Die Stifte/Buchsen sind nach dem Eindrücken in den Einsatz nicht mehr demontierbar.*

Connecting conductors to pins

⚠ ***The insulation of the conductor shall reach up to the pins. The conductor and the isolation must not be damaged.***

1. Strip off ca. 30 mm of cable insulation.(Fig.1)
2. Strip off ca. 8 mm of insulation from cable conductors.

Crimp plugs/contacts

1. Insert conductor into the connection opening of the plug/contact pin (7).
2. Crimp on all conductors using crimping tool (→ Accessories) [Fig.2]
   or
   solder all conductors to plug pins/ contact and pull shrink-on sleeve over each solder ring point.

Assembling plugs/coupler

⚠ **Also assemble plug/coupler pins that are not connected.**

❗Once they have been pressed into the plug/coupler insert, the plug pins cannot be disassembled.

Raccordement des conducteurs aux contacts mâles/ femelles

⚠ ***L'isolation du conducteur doit arriver jusqu'aux contacts . Le conducteur et isolementne doit pas être endommagé.***

1. Dénuder le câble sur env. 30 mm.(Fig.1)
2. Dénuder les conducteurs du câble sur env. 8 mm.

Présertir Fiche/Prolongateur

1. Enficher le conducteur dans l'ouverture du contact mâle/femelle (7).
2. Pré-sertir tous les conducteurs avec la pince à sertir (→ accessoire) (Fig.2).
   ou
   braser tous les conducteurs avec les contacts mâles/femelles et enfiler la gaine thermorétractable sur chaque brasure.

Montage de la fiche/du prolongateur

⚠ ***Monter aussi les contacts mâles/femelles non raccordés.***

❗Les contacts mâles/femelles ne peuvent plus être démontés après avoir été pressés dans le bloc de fiche.

1. Druckstück (2), Zugentlastung (3), Dichtung (4) und Druckscheibe (5) auf Kabel aufschieben.
2. Der Stift/die Buchse der Position 7 hat einen größeren Durchmesser. Diesen zuerst in seine Halterung stecken.
   Alle Stifte / Buchsen (7) bis zum hörbaren Einrasten in die Sechskantführung des Einsatzes (8) drücken (Fig.3).
3. Isolierhülse (6) auseinander ziehen und um die Leiter bis zum Einrasten wieder zusammendrücken (Fig.3).
4. Isolierhülse (6) auf Einsatz (8) schieben.
5. Einsatz (8) mit Führungsnase in die Führungs-nut der Hülse (10) stecken (Fig.4).
6. Druckscheibe (5), Dichtung (4), Zugentlastung (3) montieren.
7. Druckstück (2) festschrauben (Drehmoment -> Technische Daten).
8. Arretierschraube (1) festschrauben.

Normenkonformität

Das Steckverbindungssystem entspricht den in der Konformitätserklärung aufgeführten Normen und den vergleichbaren
IEC Standards
IEC 60079-0, IEC 60079-1,
IEC 60079-7, IEC 61241-0,
IEC 61241-1.
CAN/CSA C22.2 E60079-0-02
CAN/CSA C22.2 E60079-1-02
CAN/CSA C22.2 E60079-7-2003
CAN/CSA C22.2 No 213
CAN/CSA C22.2 No 182.3 M1987
CAN/CSA C22.2 No 94.1-07
94/9 EG: Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen.
Das Steckverbindungssystem ist gemäß DIN EN ISO 9001 entwickelt, gefertigt und geprüft worden.

1. Push pressure piece (2), strain relief (3), seal (4) and thrust washer (5) on to cable.
2. The plug/contact pin, Item 7, is larger in diameter. To avoid mistakes, put this into the holder first. Push all the plug pins (7) into the hexa gonal keyways of the plug/coupler insert until they engage [Fig.3].
3. Pull the insulating sleeve (6) apart and press the conductors together again until they engage [Fig.3].
4. Push the insulating sleeve (6) on to the plug insert (8).
5. Insert the plug insert (8) with guide lug into the keyway of the plug sleeve (9) [Fig.4].
6. Fit thrust washer (5), seal (4) and strain relief (3).
7. Screw pressure piece (2) tight [torque -> Technical Data]
8. Tighten locking screw (1).

Conformity with standards

The plug and socket system is conform to the standards specified in the EC-Declaration of conformity and additional conform to the comparable IEC Standards
IEC 60079-0, IEC 60079-1,
IEC 60079-7, IEC 61241-0,
IEC 61241-1.
CAN/CSA C22.2 E60079-0-02
CAN/CSA C22.2 E60079-1-02
CAN/CSA C22.2 E60079-7-2003
CAN/CSA C22.2 No 213
CAN/CSA C22.2 No 182.3 M1987
CAN/CSA C22.2 No 94.1-07
94/9 EC: Equipment and protective systems intended for use in potentially explosive atmospheres.
It has been designed, manufactured and tested according to the state of the art and to
DIN EN ISO 9001

1. Monter la pièce de pression (2), la décharge de tension (3),
2. Le contact mâle/femelle de la position 7 a un plus gros diamètre. Pour éviter toute confusion, enficher celui-ci en premier dans son support. Enfoncer tous les contacts mâlesfemelles (7) jusqu'à l'enclenchement dans le guidage hexagonal du bloc de fiche (8) (Fig.3).
3. Ecarter la douille isolante (6) puis la comprimer autour des conducteurs jusqu'à l'enclenchement (Fig.3).
4. Monter la douille isolante (6) sur le bloc de fiche (8).
5. Engager le bloc de fiche (8) avec l'ergot de guidage dans la rainure de guidage (10) de la douille de fiche (Fig.4).
6. Monter la rondelle de pression (5), le joint (4), la décharge de tension (3).
7. Visser la pièce de pression (2) (couple -> Caractéristiques techniques).
8. Visser la vis d'arrêt (1).

Conformité avec les normes

Les boîtes à bornes sont conformes aux normes reprises dans la déclaration de conformité et supplémentaires conformes à la comparables aux IEC Standards
IEC 60079-0, IEC 60079-1, I
EC 60079-7, IEC 61241-0,
IEC 61241-1.
CAN/CSA C22.2 E60079-0-02
CAN/CSA C22.2 E60079-1-02
CAN/CSA C22.2 E60079-7-2003
CAN/CSA C22.2 No 213
CAN/CSA C22.2 No 182.3 M1987
CAN/CSA C22.2 No 94.1-07
94/9 CE: Appareils et systèmes de protection destinés à être utilisés en atmosphère explosible.
Les boîtes à bornes ont été conçues, fabriquées et contrôlées suivant DIN EN ISO 9001.

COOPER Crouse-Hinds

EG-Konformitätserklärung
EC-Declaration of conformity
CE-Déclaration de conformité
PTB 06 ATEX 1031 X

GHG 900 1000 P0048 B

Wir / we / nous

Cooper Crouse-Hinds GmbH
Neuer Weg-Nord 49
D-69412 Eberbach

erklären in alleiniger Verantwortung, dass die
hereby declare in our sole responsibility, that the
déclarons de notre seule responsabilité, que le

Mehrfachsteckverbindung eXLink 6-/7-polig
multiple plug and socket systems eXLink, 6-/7-pole
multiple fiches et prises eXlLink, à 6-/7-pôles

⟨Ex⟩ II 2 G Ex de IIC T6 // ⟨Ex⟩ II 2 G Ex ia/ib IIC T6

Typ GHG 57.

auf die sich diese Erklärung bezieht, mit den folgenden Normen oder normativen Dokumenten übereinstimmen.
which are the subject of this declaration, are in conformity with the following standards or normative documents.
auquel cette déclaration se rapporte, est conforme aux normes ou aux documents normatifs suivants.

Bestimmungen der Richtlinie Terms of the directive Prescription de la directive		Titel und / oder Nr. sowie Ausgabedatum der Norm. Title and / or No. and date of issue of the standard. Titre et / ou No. ainsi que date d'émission des normes.
94/9/EG:	Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen.	**EN 60 079-0: 2004** **EN 60 079-1: 2004** **EN 60 079-7: 2004** **EN 60 079-11: 2007**
94/9/EC:	Equipment and protective systems intended for use in potentially explosive atmospheres.	**EN 60 529: 1991 + A1: 2000** **EN 61 984: 2001** **EN 60 999-1: 2000**
94/9/CE:	Appareils et systèmes de protection destinés à être utilisés en atmosphère explosibles.	
2004/108 EG: *2004/108 EC:* *2004/108 CE:*	Elektromagnetische Verträglichkeit *Electromagnetic compatibility* *Compatibilité électromagnétique*	**EN 60 947-1: 2007**

Eberbach, den 17.09.09

i.A. i.V.

Ort und Datum *Place and date* *Lieu et date*	i.A. R. Brandel Leiter Labor *Head of Laboratory* *Chef du dépt. Laboratoire*	i.V. H. Huter Leiter Approbation *Head of Approval office* *Chef du dépt. approbation*

PTB 96 ATEX Q 1 - 5

Zertifizierungsstelle *Notified Body of the certification* *Organes Notifié et Compétent*	**Physikalisch-Technische Bundesanstalt (0102)** **Bundesallee 100** ***D-38116 Braunschweig***
Konformitätsbewertungsstelle *Notified Body to quality evaluation* Organes d'attestation de conformité	**Physikalisch-Technische Bundesanstalt (0102)** **Bundesallee 100** **D-38116 Braunschweig**

Für den Sicheren Betrieb des Betriebsmittels sind die Angaben der zugehörigen Betriebsanleitung zu beachten.
For the safe use of this apparatus, the informations given in the accompanying operating instructions must be followed.
Afin d'assurer le bon fonctionnement de nos appareils, priére de respecter les directives du mode d'emploi correspondent à ceux-ci.

CEAG

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E-Mail: info-ex@ceag.de

eXLink 6+1-polig Gerätestecker, Flanschsteckdose/
6+1-pole Inlet, Flange/
6+1 la prise et le prolongateur

COOPER Crouse-Hinds

Technische Angaben	
Gerätekennzeichnung nach 94/9/EG:	Ex II 2G Ex de IIC T6/ Ex II 2G Ex ia/ib IIC T6
nach CSA	Class I, Zone 1 Ex de IIC T6 Class I, Div 2; Gr. A,B,C,D
EG-Baumusterprüf-bescheinigung:	PTB 06 ATEX 1031 X
Zulässige Umgebungs-temperatur:	-25°C/-55°C bis +40°C[1]
Bemessungsspannung:	bis 400 V, 50/60 Hz
Bemessungsstrom:	max. 16 A
Anschlussleitung:	AWG22 Metrofunk AWG26 Metrofunk
Anschlussquerschnitt:	AWG22, AWG26
Vibrationsfestigkeit nach EN 60068-2-6 10-150 Hz:	2g / 30 min[2]
Prüfdrehmomente:	
Arretierungsschraube:	1,0 Nm
Einschraubgewinde Steck-dose, Gerätestecker	30 Nm
Überwurfmutter:	2,5 Nm (handfest)

1) die besonderen Bedingungen gemäß Prüfschein PTB 03 ATEX 1016 X sind zu beachten.
2) Die Hinweise im Kapitel „Montage“ beachten!

Technical Data	
Apparatus marking acc. to 94/9/EC:	Ex II 2G Ex de IIC T6/ Ex II 2G Ex ia/ib IIC T6
acc. CSA	Class I, Zone 1 Ex de IIC T6 Class I, Div 2; Gr. A,B,C,D
EC type examination certificate:	PTB 06 ATEX 1031 X
Permissible ambient temperature:	-25°C/-55°C to +40 °C[1]
Rated voltage:	up to 400 V, 50/60 Hz
Rated current:	max. 16 A
Cable:	AWG22 Metrofunk AWG26 Metrofunk
Terminal cross section:	AWG22, AWG26
Vibration resistance acc. EN 60068-2-6 10-150 Hz:	2g / 30 min[2]
Test torques	
Locking screw:	1.0 Nm
Screw-in thread - flange socket, inlet:	30 Nm
coupling nut:	2,5 Nm (by hand)

1) observe special requirements accd. certifcation PTB 03 ATEX 1016 X.
2) Follow the instructions in the chapter ´Installation

Caractéristiques techniques	
Marquage de l’appareil selon 94/9/CE:	Ex II 2G Ex de IIC T6/ Ex II 2G Ex ia/ib IIC T6
en fonction de CSA	Class I, Zone 1 Ex de IIC T6 Class I, Div 2; Gr. A,B,C,D
Attestation d’examen CE de type:	PTB 06 ATEX 1031 X
Température ambiante admissible:	-25°C/-55°C à +40°C[1]
Tension nominale:	jusqu’à 400 V, 50/60 Hz
Courant nominal:	max. 16 A
Cable:	AWG22 Metrofunk AWG26 Metrofunk
Section raccordement:	AWG22, AWG26
Résistance aux vibrations selon EN 60068-2-6 10-150 Hz:	2g / 30 min[2]
Couples de serrage testés	
Vis d´arrêt:	1,0 Nm
Filets de vis de prise à pride, connecteur:	30 Nm
Ecrou(Bien serrer à la main):	2,5 Nm

1) Respecter les précautions particulières selon l'attestation d'examen CE de type PTB 03 ATEX 1016 X
2) Suivre les instructions du chapitre ´Montage!

Sicherheitshinweise

Zielgruppen dieser Anleitung sind Elektrofachkräfte und unterwiesene Personen in Anlehnung an die EN/IEC 60079-14.

Die Montageanleitung nur zusammen mit der ausführlichen Betriebsanleitung „GHG5707005P0001“ (unter www.ceag.de erhältlich) verwenden.

Die Benutzerinformationen für „MOOG-Ventile“ sind zu beachten (www.Moog.com/industrial).

Das Konfektionieren der Steckverbinder darf nur durch Fachkräfte erfolgen.

Die auf den Geräten angegebene Temperaturklasse und Zündschutzart ist zu beachten.

Die Steckverbindung ist nicht für den Einsatz im explosionsgefährdeten Bereich der Zone 0 und Zone 20, 21, 22 gemäß EN60079-10 geeignet.

Steckverbinder unter Last nur mit den Werten der Technischen Daten betreiben.

Trennen unter Belastung maximal bis 230 V / 400 V , 10 A möglich.

Gerätestecker und Flanschsteckdosen aus Metall sind durch geeignete Maßnahmen in das Erdpotential der Gehäuse bzw. Geräte mit einzubeziehen. Steckverbindung nur in technisch einwandfreiem Zustand sowie bestimmungsgemäß, sicherheits- und gefahrenbewusst unter Beachtung dieser Montage- und Betriebsanleitung montieren und betreiben.
Die unter Spannung stehenden Steck-verbindungskomponenten müssen sofort nach dem Trennen mit der Schutzkappe verschlossen werden, damit die Schutzart und damit der Explosions-schutz sichergestellt wird.

Safety instructions

Operations shall be carried out by electricians and suitably personnel trained in hazardous area with knowledge of increased safety explosion protection in accordance with IEC 60079-14.
The assembly instructions must be used in conjunction with the detailed operating instructions “GHG5707005P0001” (available from www.ceag.de).

The user information for „MOOG-Ventile“ must to be observed.

The connection of plug and socket systems shall only be carried out by qualified personnel.
The temperature class and explosion group marked on the terminal boxes have to be observed.

The plug and socket system is not suitable for Zone 0 and tone 20, 21, 22 hazardous areas accordance with EN 60079-10.

The plug and socket system may only be connected or disconnected under load acc. to technical data. (230 V / 400 V max. 10 A).
The metal flang sockets and inlets shall be incorporated in the earth potential eyualization.
These assembly and operating instructions shall be observed when installing and operating the plug and socket connector system. It shall only be used in a technically perfect state and in accordance with the intended purpose while paying attention to the particular safety and hazard aspects.

The national safety rules and regulations for the prevention of accidents, as well as the safety instructions included in these operating instructions, that, like this text, are set in italics, shall be observed!
Here it is necessary to ensure that it is closed correctly, otherwise the minimum degree of protection and the explosion protection are no longer guaranteed.

Consignes de sécurité

Ce mode d’emploi s’adresse aux électriciens et personnes initiées sur base de la norme CEI 60079-14.
Utilisez la notice de montage uniquement en association avec les instructions détaillées de service “GHG5707005P0001” (disponibles sur le site www.ceag.de).

Les informations utilisateur pour les „MOOG-Ventile“ doivent être respectées.

Seul un personnel qualifié est autorisé à effectuer le branchement électrique des connecteurs mâles-femelles.
Le groupe d’explosion et la classe de température marqués sur les appareils devront être respectés.

Le connecteur n’est pas conçu pour être utilisé dans les atmosphères explosibles des zones 0 et 20, 21, 22 conformément à CEI 60079-10.

Respecter impérativement les valeurs indiquées dans les caractéristiques techniques pour les connecteurs sous charge. Ne séparer qu'à 230 V / 400 V 10 A.

Les prises à bride aux métal et les sockles connecteur aux métal doivent être reliés au même potentiel.
Monter et utiliser le connecteur seulement s’il présente un état technique parfait, conformément à sa destination, en étant conscient des risques et des mesures de sécurité à appliquer dans le respect d es présentes instructions de montage et de service.
Tenir compte des prescriptions nationales en matière de sécurité et de prévention des accidents ainsi que des consignes de sécurité indiquées dans ce mode d’emploi, écrites en italiques comme ce texte!

Après déconnexion, les éléments de connexion encore sous tension doivent immédiatement être protégés à l’aide d’obturateurs.

GHG 570 7005 P0102 D/E/F (b)/Auflage/38.11/Ziegler

Fig. A

Fig. B

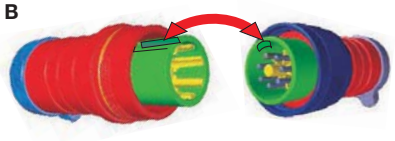


Fig. C

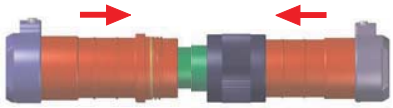


Fig. D

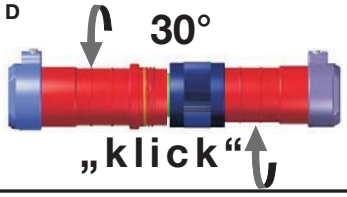
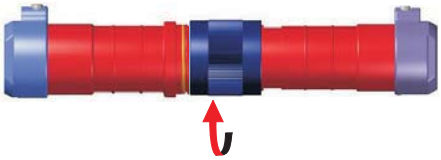


Fig. E

Fig. F



Steckverbindung stecken/trennen

⚠ Die Flanschsteckdosen und Gerätestecker nur mit den zugehörigen unbeschädigten Steckern und Kupplungen betreiben.

⚠ Auf gleiche Codierung (Uhrzeit) der Steckverbindung achten.

i Der Winkel zwischen Führungsnase und PE Stift (mit größerem Durchmesser) ergibt die Uhrzeit. (Fig. A)

Steckverbindung stecken

1. Der Stecker bzw. Gerätestecker mit der Führungsnase lagerichtig in die entsprechende Führungsnute der Kupplung bzw. Flanschsteckdose stecken. (Fig. B)
2. Bis zum 1. Anschlag zusammenstecken.(Fig. C)
3. Stecker bzw. Gerätestecker gegen Kupplung bzw. Flanschsteckdose ca. 30° gegeneinander bis zum Anschlag verdrehen. (Fig. D)
4. Steckverbindung vollständig zusammenstecken.(Fig. E)

i Die elektrische Verbindung des Stecksystems ist jetzt hergestellt.
5. Überwurfmutter des Steckers andrücken und handfest festschrauben.

! *IP Schutz und die mechanische Verbindung hergestellt.*(Fig. F)

Steckverbindung trennen

1. Steckverbindung in umgekehrter Reihenfolge zum Stecken trennen.

⚠ Bei nicht korrektem Stecken der Steckverbindungskomponenten ist der Explosionsschutz nicht mehr gewährleistet.

Connection/disconnection of plug and socket

⚠ The flange sockets and inlets shall only be operated with the associated, undamaged plugs and couplers.

⚠ Attention shall be paid that the coding (time setting) of the plugs and sockets is the same.

i The time of day is the angle between the guide lug and the PE pin (larger in diameter). (Fig. A)

Connecting plug and socket

1. Insert the plug or inlet with the guide lug in the correct position into the respective keyway of the coupler or flange socket.(Fig. B)
2. Insert until 1st stop is reached.(Fig. C)
3. Turn plug or inlet through ca. 30° in relation to the coupler or flange socket until the stop is reached.(Fig. D)
4. Join plug and socket completely.(Fig. E)

i The electrical connection has now been made.
5. Press the coupling nut of the plug on and screw it tight by hand.

! The IP degree of protection and the mechanical connection are established by tightening the coupling nut.(Fig. F)

Disconnecting plug and socket

1. To disconnect plug and socket, carry out the above actions in the reverse order.

⚠ When opened, the live plug and socket system components shall be sealed immediately after disconnection using the protective cap.

Branchement/Débranchement du connecteur

⚠ N'utiliser les prises de courant à bride et les socles connecteurs qu'avec des fiches et prolongateurs compatibles intacts.
⚠ Veiller à un codage identique (heure) du connecteur.

i L'angle entre l'ergot de guidage et le contact mâle PE (d'un plus grand diamètre) donne l'heure. (Fig. A)

Branchement du connecteur

1. Engager dans la bonne position la fiche/le socle connecteur avec l'ergot de guidage dans la rainure de guidage correspondante du prolongateur/de la prise de courant à bride**.** (Fig. B)
2. Brancher les deux éléments jusqu'à la butée 1
3. Tourner dans des sens contraires, d'env. 30°, la fiche/le socle connecteur et le prolongateur/la prise de courant à bride jusqu'en butée.(Fig. D)
4. Le connecteur mâle-femelle boucher tout à fait.(Fig. E)

i Le branchement électrique du système de connexion est maintenant réalisé.
5. Appuyer l'écrou-raccord de la fiche et le visser. (Bien serrer à la main).

! Le vissage de l'écrou-raccord a pour effet d'établir la protection IP et la liaison mécanique.(Fig. F)

Débranchement du connecteur

1. Débrancher le connecteur dans l'ordre inverse du branchement.

⚠ Les éléments de connexion conducteurs de tension à l'état ouvert doivent être fermés avec le capuchon dès le débranchement .

Anschlussleiter von Gerätestecker/Flanschsteckdose vorbereiten

Kabel und Leiter entsprechend den Technischen Daten verwenden.

! *Bei mehr- oder feindrähtigen Leitern die Enden entsprechend den geltenden nationalen und internationalen Vorschriften behandeln (z.B. Verwenden von Aderendhülsen).*

Die ordnungsgemäß abisolierten Leiter des Kabels unter Berücksichtigung einschlägiger Vorschriften anschließen.

Leiteranschluss zur Aufrechterhaltung der Zündschutzart mit besonderer Sorgfalt durchführen.

Prepare connection conductors of inlet / flange socket

Only use cables and conductors specified in the Technical Data.

! *With multi-wire or fine-wire connection leads, the ends of the wires shall be treated in accordance with the valid national or international regulations (e.g. the use of wire-end ferrules).*

The insulation of the conductor shall reach up to the plug pins. The conductor must not be damaged
The relevant regulations shall be observed to ensure that the conductors of the cable are stripped off correctly.
The conductors shall be connected with due care to ensure that the degree of protection is maintained.

Préparation conducteurs de raccordement du socle connecteur / de la prise de courant à bride

Utiliser les câbles et les conducteurs conformément aux Caractéristiques techniques.

! *Avec des conducteurs multifilaires ou à fils fins, traiter les extrémités conformément aux directives nationales et internationales (par ex. en utilisant des embouts).*

Raccorder les conducteurs correctement isolés du câble en respectant les directives correspondantes.

Effectuer le raccordement du conducteur avec beaucoup de soin pour garantir la protection contre les explosions.

Gerätestecker / Flanschsteckdose einschrauben

Gerätestecker bzw. Flanschsteckdose nur in die dafür vorgesehene Gehäuse einbauen.
Das Gehäusevolumen bei der Auswahl des Gerätesteckers berücksichtigen.

Die Gewindebohrungen im druckfesten Schutzgehäuse oder Einbaugeräten, müssen den Mindestanforderungen der EN 60079-1, entsprechen.

Zur Sicherstellung des Explosionsschutzes in die Bohrungen von druckfesten Gehäusen nur Gerätestecker und Flanschsteckdosen aus Metall mit der geeigneten Zündschutzart verwenden.

Die Einschraubgewinde dürfen nicht verschmutz oder beschädigt sein.

Nur die im Gerätestecker bzw. in der Flanschsteckdose vorhandenen Dichteinsätze verwenden.

Beim Einschrauben der Gerätestecker bzw. der Flanschsteckdosen auf die angeschlossenen Leitungen bzw. Adern achten, damit keine Beschädigung der Isolation durch das Einschrauben entsteht.

Die Einschraubkomponenten sind so fest einzuschrauben, dass eine korrekte Dichtwirkung gewährleistet ist. (Prüfdrehmoment siehe Technische Daten).

Die Gerätestecker und Flanschsteckdosen aus Metall in das Erdpotential mit einbeziehen.

Vor dem Stecken sicherstellen, dass Gerätestecker und Flanschsteckdosen nicht beschädigt sind.

1. Gerätestecker bzw. Flanschsteckdose mit Verdrehschutz einschrauben (Prüfdrehmoment -> Technische Daten).
2. Verdrehschutzschraube festdrehen.
3. Gerätestecker bzw. Flanschsteckdosen durch kontern sichern.
   Den Gerätestecker nicht durch verkleben gegen Lösen sichern, da sonst Funktionsstörungen auftreten können.

Screw in inlet / flange socket

Inlets or flange sockets shall only be built into enclosures intended for this purpose.
Observe the flameproof enclosure volume when flange-socket selecting.

The threaded holes in the flameproof enclosure shall fulfil the minimum requirements of EN 60079-1.

To ensure the explosion protection, only fit inlets and flange sockets made of metal in the appropriate type of protection into the threaded holes of flameproof enclosures.

The screw-in thread must not be dirty or damaged.

Only use the seal inserts provided in the inlet or flange socket.

When screwing in the inlet or flange socket, pay attention to the connected conductors to ensure that the insulation is not damaged in the process.

The screw-in components shall be tightened down in such a way that they are properly sealed (see Technical Data for test torque).

The inlets and flange sockets shall be incorporated in the earth potential.

Before use, ensure that inlets and flange sockets are not damaged.

1 Fit inlet or flange socket with anti-twist protection, (test torque -> Technical Data).
2. Tighten anti-twist screw.
3. Fit inlet or flange socket with anti-twist protection (7), (test torque -> Technical Data).

Vissage du connecteur / de la prise de courant à bride

Ne monter le socle connecteur ou la prise de courant à bride que dans les boîtiers prévus à cet effet.Observez le volume de l'enceinte antidéflagrante lors socle connecteuravec sélection.

Les alésages filetés du boîtier de protection ou appareil à encastrer résistant à la pression doivent satisfaire aux exigences minima de la norme EN 60079-1.

Pour garantir la protection contre les explosions, n'utiliser dans les orifices des boîtiers résistant à la pression que des socles connecteurs et des prises de courant à bride en métal, présentant le type de protection contre les explosions approprié.

Les filetages ne doivent pas être sales ou endommagés.

N'utiliser que les éléments d'étanchéité disponibles dans le socle connecteur ou la prise de courant à bride.

En vissant le socle connecteur ou la prise de courant à bride sur le câble ou le fil connecté, veiller à ne pas endommager l'isolation.

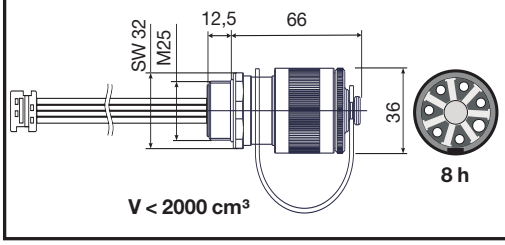
Les éléments de vissage doivent être vissés avec un couple assurant une bonne étanchéité. (Couples de contrôle voir les Caractéristiques techniques)

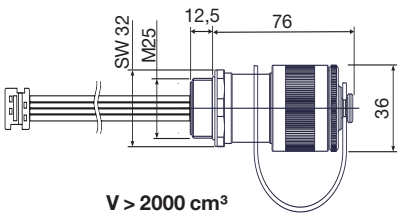
Intégrer les socles connecteurs et les prises de courant à bride en métal dans le potentiel terrestre.

Avant la connexion, s'assurer que les socles connecteurs et les prises de courant à bride sont en bon état.

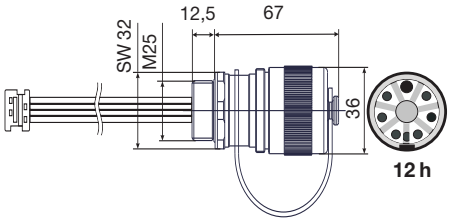
1. Visser le socle connecteur ou la prise de courant à bride avec la protection antitorsion (Couples de contrôle -> Caractéristiques techniques).
2. Serrer à fond la vis de protection antitorsion.
3. Bloquer le socle connecteur ou la prise de courant à bride par contre-écrou.
   Ne pas coller le socle connecteur pour l'empêcher de se desserrer, cela risquerait d'entraîner des dysfonctionnements.

Gerätestecker mit Anschlussleitung
Inlet with connection leads
Socle connecteuravec lignes de raccordement





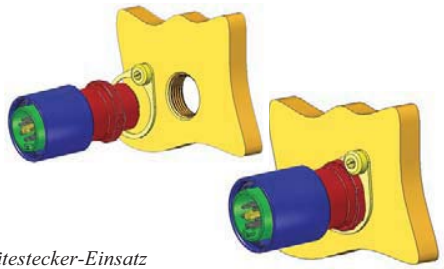
Flanschsteckdose mit Anschlussleitung
Flange socket with connection leads
Prise à bride avec lignes de raccordement



Das Gehäusevolumen bei der Auswahl des Gerätesteckers berücksichtigen.

Observe the flameproof enclosure volume when flange-socket selecting.

Observez le volume de l'enceinte antidéflagrante lors socle connecteuravec sélection.



1	*Überwurfmutter* *Ecrou-raccord* *Ecrou-raccord*	*4*	*Gerätestecker-Einsatz* *Bloc de socle connecteur* *Bloc de socle connecteur*
2	*Gerätestecker-Hülse* *Douille du socle connecteur* *Douille du socle connecteur*	*5*	*Flanschsteckdosen Hülse* *Douille de la prise de courant à bride* *Douille de la prise de courant à bride*
3	*Anschlusskabel* *Câble de raccordement* *Câble de raccordement*	*6*	*Flanschsteckdosen-Einsatz* *Bloc de prise de courant à bride* *Bloc de prise de courant à bride*

Normenkonformität

Das Steckverbindungssystem entspricht den in der Konformitätserklärung aufgeführten Normen und den vergleichbaren IEC Standards
IEC 60079-0, IEC 60079-1, IEC 60079-7,
IEC 61241-0, IEC 61241-1.
CAN/CSA C22.2 E60079-0-02
CAN/CSA C22.2 E60079-1-02
CAN/CSA C22.2 E60079-7-2003
CAN/CSA C22.2 No 213
CAN/CSA C22.2 No 182.3 M1987
CAN/CSA C22.2 No 94.1-07
94/9 EG: Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen.
Das Steckverbindungssystem ist gemäß DIN EN ISO 9001 entwickelt, gefertigt und geprüft worden.

Conformity with standards

The plug and socket system is conform to the standards specified in the EC-Declaration of conformity and additional conform to the comparable IEC Standards
IEC 60079-0, IEC 60079-1, IEC 60079-7,
IEC 61241-0, IEC 61241-1.
CAN/CSA C22.2 E60079-0-02
CAN/CSA C22.2 E60079-1-02
CAN/CSA C22.2 E60079-7-2003
CAN/CSA C22.2 No 213
CAN/CSA C22.2 No 182.3 M1987
CAN/CSA C22.2 No 94.1-07
94/9 EC: Equipment and protective systems intended for use in potentially explosive atmospheres.
It has been designed, manufactured and tested according to the state of the art and to DIN EN ISO 9001.

Conformité avec les normes

Les boîtes à bornes sont conformes aux normes reprises dans la déclaration de conformité et supplémentaires conformes à la comparables aux IEC Standards
IEC 60079-0, IEC 60079-1, IEC 60079-7,
IEC 61241-0, IEC 61241-1.
CAN/CSA C22.2 E60079-0-02
CAN/CSA C22.2 E60079-1-02
CAN/CSA C22.2 E60079-7-2003
CAN/CSA C22.2 No 213
CAN/CSA C22.2 No 182.3 M1987
CAN/CSA C22.2 No 94.1-07
94/9 CE: Appareils et systèmes de protection destinés à être utilisés en atmosphère explosible.
Les boîtes à bornes ont été conçues, fabriquées et contrôlées suivant DIN EN ISO 9001.

COOPER Crouse-Hinds

EG-Konformitätserklärung
EC-Declaration of conformity
CE-Déclaration de conformité
PTB 06 ATEX 1031 X

GHG 900 1000 P0048 B

Wir / we / nous

Cooper Crouse-Hinds GmbH
Neuer Weg-Nord 49
D-69412 Eberbach

erklären in alleiniger Verantwortung, dass die Mehrfachsteckverbindung eXLink 6-/7-polig
hereby declare in our sole responsibility, that the multiple plug and socket systems eXLink, 6-/7-pole
déclarons de notre seule responsabilité, que le multiple fiches et prises eXILink, à 6-/7-pôles

Ⓔx II 2 G Ex de IIC T6 // Ⓔx II 2 G Ex ia/ib IIC T6 **Typ GHG 57.**

auf die sich diese Erklärung bezieht, mit den folgenden Normen oder normativen Dokumenten übereinstimmen.
which are the subject of this declaration, are in conformity with the following standards or normative documents.
auquel cette déclaration se rapporte, est conforme aux normes ou aux documents normatifs suivants.

Bestimmungen der Richtlinie Terms of the directive Prescription de la directive		Titel und / oder Nr. sowie Ausgabedatum der Norm. Title and / or No. and date of issue of the standard. Titre et / ou No. ainsi que date d'émission des normes.
94/9/EG:	Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen.	**EN 60 079-0: 2004** **EN 60 079-1: 2004** **EN 60 079-7: 2004** **EN 60 079-11: 2007**
94/9/EC:	Equipment and protective systems intended for use in potentially explosive atmospheres.	**EN 60 529: 1991 + A1: 2000** **EN 61 984: 2001**
94/9/CE:	Appareils et systèmes de protection destinés à être utilisés en atmosphère explosibles.	**EN 60 999-1: 2000**
2004/108 EG: *2004/108 EC:* *2004/108 CE:*	Elektromagnetische Verträglichkeit *Electromagnetic compatibility* *Compatibilité électromagnétique*	**EN 60 947-1: 2007**

Eberbach, den 17.09.09

Ort und Datum *Place and date* *Lieu et date*	i.A. R. Brandel Leiter Labor *Head of Laboratory* *Chef du dépt. Laboratoire*	i.V. H. Huter Leiter Approbation *Head of Approval office* *Chef du dépt. approbation*

PTB 96 ATEX Q 1 - 5

Zertifizierungsstelle *Notified Body of the certification* *Organes Notifié et Compétent*	**Physikalisch-Technische Bundesanstalt (0102)** **Bundesallee 100** ***D-38116 Braunschweig***
Konformitätsbewertungsstelle *Notified Body to quality evaluation* Organes d'attestation de conformité	**Physikalisch-Technische Bundesanstalt (0102)** **Bundesallee 100** **D-38116 Braunschweig**

Für den Sicheren Betrieb des Betriebsmittels sind die Angaben der zugehörigen Betriebsanleitung zu beachten.
For the safe use of this apparatus, the informations given in the accompanying operating instructions must be followed.
Afin d'assurer le bon fonctionnement de nos appareils, prière de respecter les directives du mode d'emploi correspondent à ceux-ci.

CEAG

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TAKE A CLOSER LOOK.

Moog designs a range of products that complement the performance of those featured in this document. Visit our website for more information and the Moog facility nearest you.

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Pilot-operated proportional valves D941K to D945K
Version -, April 2012, CDS29589-de